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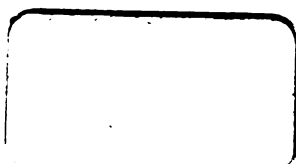
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*Chief of Engineers.*

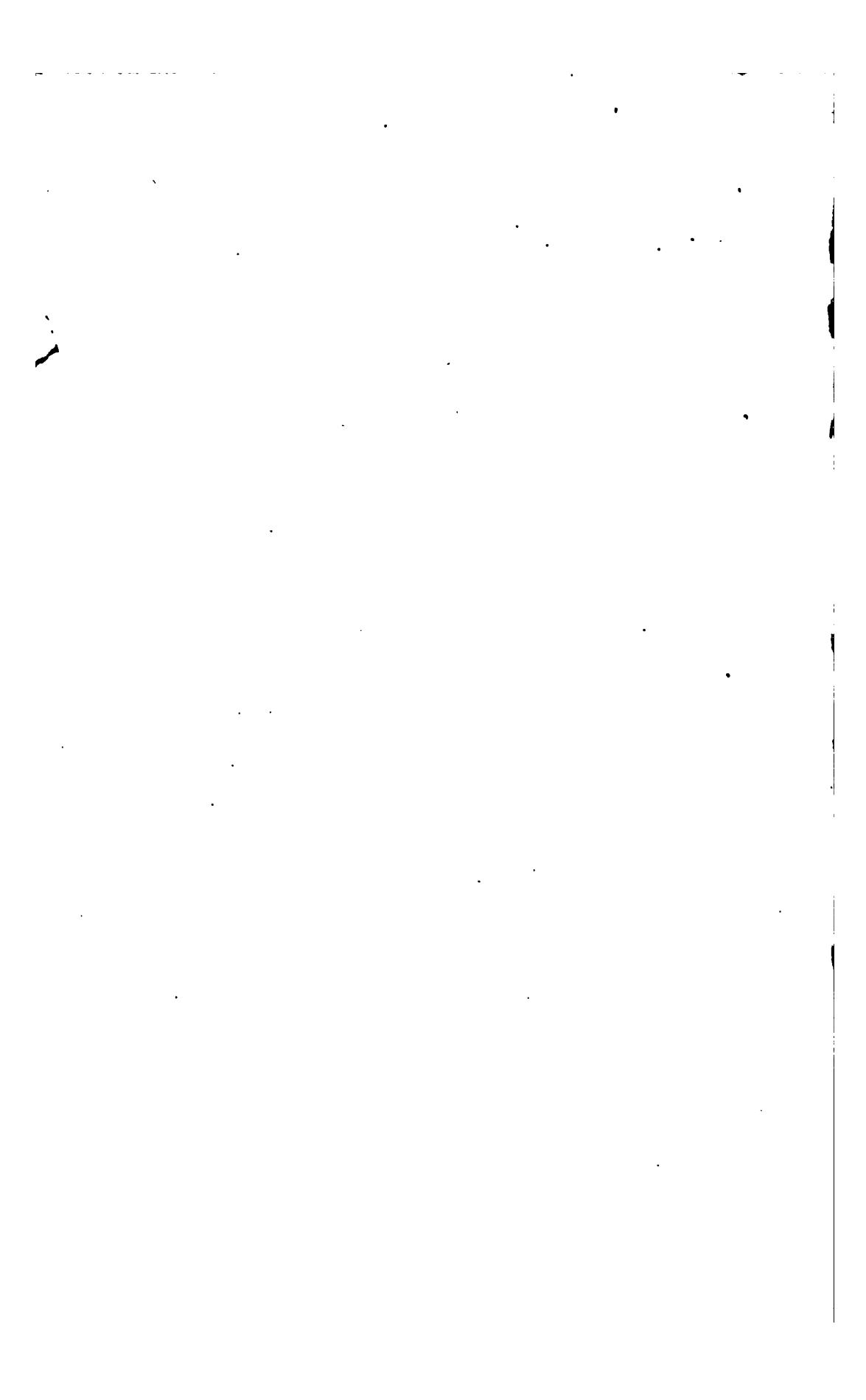
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ANALYTICAL AND TOPICAL INDEX  
TO THE REPORTS OF  
THE CHIEF OF ENGINEERS  
AND THE OFFICERS OF THE CORPS OF ENGINEERS,  
UNITED STATES ARMY,  
UPON  
WORKS AND SURVEYS  
FOR  
RIVER AND HARBOR IMPROVEMENT,  
VOL. III.—1888—1892.

---

COMPILED UNDER THE DIRECTION OF  
**Major C. W. RAYMOND, Corps of Engineers.**  
BY  
LOUIS Y. SCHERMERHORN, C. E.,  
AND  
HOLDEN B. SCHERMERHORN.

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*Smithsonian Institution*

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OFFICE OF THE CHIEF OF ENGINEERS,  
UNITED STATES ARMY,  
*Washington, D. C., November 12, 1894.*

SIR: I have the honor to submit the accompanying letter from Maj. Chas. W. Raymond, Corps of Engineers, dated November 9, 1894, forwarding manuscript of the third volume of the "Index to the Reports of the Chief of Engineers on River and Harbor Improvements." The preceding volumes of this work have proved to be of extreme value, not only to officers of the Corps of Engineers, but also to the legislative and executive departments of the Government and to civil engineers.

I beg to recommend that an edition of 1,500 copies of the third volume be printed at the Government Printing Office, and, to save expense in case further editions are called for, that it be stereotyped.

Very respectfully, your obedient servant,

THOS. LINCOLN CASEY,  
*Brig. Gen., Chief of Engineers.*

Hon. D. S. LAMONT,  
*Secretary of War.*

WAR DEPARTMENT,  
*Washington, November 16, 1894.*

Approved.

By order of the Secretary of War.

JOHN TWEEDALE,  
*Chief Clerk.*





UNITED STATES ENGINEER OFFICE,  
*Philadelphia, Pa., November 9, 1894.*

GENERAL: I have the honor to forward herewith the manuscript of the third volume of the "Index to the Reports of the Chief of Engineers on River and Harbor Improvements."

The first volume, published in 1881, covered the reports from 1866 to 1879, inclusive, which consisted of twenty-three volumes, containing 19,143 pages. The second volume, published in 1889, covered the reports from 1880 to 1887, inclusive, which consisted of twenty-seven volumes, containing 21,959 pages. The present volume extends the work from 1888 to 1892, inclusive, and covers twenty-two volumes, containing 17,031 pages. The index now covers seventy-two volumes of reports, containing an aggregate of 58,133 pages.

The plan followed in compiling the present volume is essentially that adopted in the second volume, except that the "Personal Index" and the "List of Private, Corporate, and State Work on Rivers and Harbors" are omitted. Experience seems to have shown that the former is not of sufficient utility to justify the great labor of compiling it, and there are practically no references to extend under the latter.

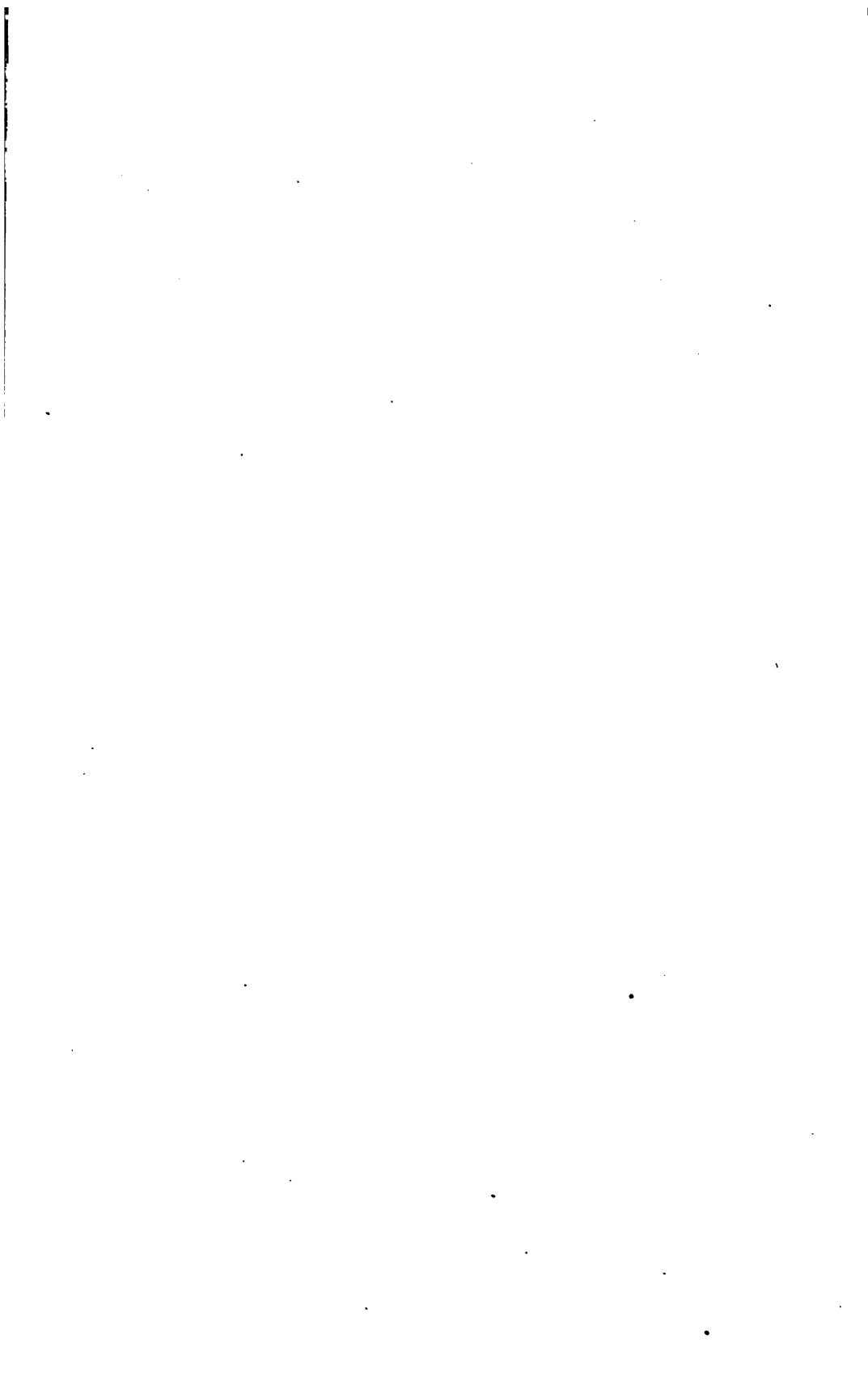
An added feature to this volume of the Index will be found in the "Abstract of laws relating to River and Harbor Improvements and other Public Works of the United States from 1790 to 1893," which it is hoped will be found useful in the investigation of the legal questions so frequently arising in our engineering practice. The introduction to the Abstract fully explains its scope and character and the authorities upon which it is based.

The original compilations for this volume have been made by Mr. Holden B. Schermerhorn, under the supervision of Mr. Louis Y. Schermerhorn, civil engineer, formerly United States assistant engineer, the gentlemen who rendered the same services in the preparation of the second volume. I am indebted to both for the faithfulness and intelligence with which they have executed the work. A special acknowledgment is due to Mr. Louis Y. Schermerhorn, who has given his time, labor, and experience to the Government without compensation.

Very respectfully, your obedient servant,

C. W. RAYMOND,  
*Major, Corps of Engineers.*

Brig. Gen. THOMAS L. CASEY,  
*Chief of Engineers, U. S. A.*



## EXPLANATION.

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*The first division, which comprises the main body of the work, is arranged for each improvement under the following headings:—*

**APPROPRIATIONS:** Including an aggregate of all appropriations made by Congress prior to 1888, and in detail appropriations from 1888 to and including the act of July 13, 1892.

**COMMERCE:** Including only special allusions to commerce; routine commercial statistics required with each annual report are not included, as they are to be found at the end of each report.

**CONTRACTS:** Including contracts, with prices, but not proposals.

**ENGINEERS:** Subdivided as follows: (1) *Chief of Engineers*; (2) *Boards of Engineers*, when any such were appointed in connection with the work; (3) *Engineers in charge*; (4) *Assistants*.

[**ESTIMATES:** Always incorporated with Plans and Projects.]

**LEGAL PROCEEDINGS:** Including proceedings of courts, Department of Justice, etc.

**LEGISLATION:** By Congress or the several States, except the acts making appropriations and ordering surveys.

[**MAPS:** Placed as a subheading under Surveys whenever published in the reports.]

**OBSTRUCTIONS:** Including all artificial obstructions to navigation, as bridges, dams, etc.

**OPERATIONS:** Including a brief statement of the operations of each year.

**PHYSICAL CHARACTERISTICS:** Including references to the physical geography of localities, the gauging of rivers, rainfall, drainage areas, etc.

**PLANS:** Including all plans proposed which were not adopted by authority as the projects for the improvement. (See Projects, below.)

**PRIVATE, CORPORATE, AND STATE WORK** done on the improvement, as far as mentioned in the reports.

**PROJECTS:** As adopted by the engineer in charge or Boards of Engineers, with the estimated cost of each, and such details as are of greatest importance, with full references to the same and to any modifications made; together with a brief history of the approved projects previous to 1880. (See Plans, above.)

**SURVEYS:** Including references to Examinations and Surveys made and to Maps published in the reports.

The indexes of Examinations and Surveys, where no improvements have been made, and of Bridges over Navigable Waters, are arranged in a somewhat different manner from works of improvement, according to the material on hand.

### ABBREVIATIONS AND REFERENCES.

The few abbreviations used (as Maj., Col., lin. ft., cub. yds., etc.) will be readily understood. The references to the Annual Reports of the Chief of Engineers are printed with the year (omitting the "18") in heavy face type, and the page in ordinary type, thus: "86, 1921." In the report of 1877 the plan was commenced of paging each annual report continuously, regardless of volumes, and therefore the number of the volume is ignored in the references in this Index, excepting where it is necessary to refer to a report prior to 1877, when the volumes are indicated by the Roman numerals, i, ii, iii, iv.



# INDEX

OF

## WORKS AND SURVEYS FOR IMPROVEMENT OF RIVERS AND HARBORS.

### AGATE BAY, MINN.—IMPROVEMENT OF.

(Continued from Vol. II, p. 11.)

#### Appropriations.

1886-'87 .....	\$22,500
1888 .....	15,000, '88, 1813.
1890 .....	25,000, '90, 2284.
1892 .....	30,000, '92, 2125.

Total..... 92,500

List of Appropriations, '90, 2284.

#### Contracts.

1888. Thomas Dwyer, for timber breakwater construction at a total of \$12,449, '89, 1999.

1891. Campbell & McDonald, for construction of 200 linear feet of breakwater at \$23,400, '91, 2487.

#### Engineers.

CHIEF OF ENGINEERS.

Reports, '88, 231; '89, 268; '90, 241; '91, 311; '92, 296.

ENGINEERS IN CHARGE.

Maj. J. B. Quinn, 1886-'92. Reports, '88, 1812; '89, 1998; '90, 2283; '91, 2486.

Capt. W. L. Fisk, 1892-'— Report, '92, 2123.

#### Operations.

1887-'88. 400 linear feet of east breakwater built, '88, 1812.

1888-'89. Breakwater extension continued, '89, 1998.

1889-'90. 150 linear feet of east breakwater built, '90, 2284.

1890-'91. Extension of east breakwater continued, '91, 2486.

1891-'92. Breakwater extension continued, '92, 2124.

#### Physical Characteristics.

Description of the locality, '88, 1812; '90, 2283.

#### Projects.

By Maj. Quinn, 1887, for the construction of two breakwaters in Agate Bay, 1,000 and 900 feet, respectively, and extending from the easterly and westerly points of the bay; the opening between the ends of the breakwaters to be 1,340 feet and the area inclosed, 109 acres; estimated cost, \$213,000, '87, 1951. Increased in 1888 to \$243,500, '88, 1812; '89, 1998; '90, 311.

### AHTNAPEE HARBOR. WIS.—IMPROVEMENT OF

(Continued from Vol. II, p. 12.)

#### Appropriations.

1871-'87 .....	\$155,000
1888 .....	5,000, '88, 1847.
1890 .....	6,000, '90, 2339.
1892 .....	7,000, '92, 2183.

Total ..... 173,000

List of appropriations, '92, 2185.

**AHNAPEE HARBOR, WIS.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 239; '89, 278; '90, 251; '91, 321; '92, 307.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886 '92. Reports, '88, 1846; '89, 2053; '90, 2338; '91, 2538.

Maj. J. F. Gregory, 1892-'— Report, '92, 2184.

**Operations.**

1887-'88. No operations pending the securing of free wharfage over Government piers, '88, 1846.

1888-'89. In 1889 operations were resumed, it being recommended that the proviso as to free wharfage be omitted from future appropriations.

3,496 cubic yards rock and 19,965 cubic yards sand removed from the channel; crib in south pier reset; 250 linear feet south pier superstructure built; 150 linear feet north pier extension completed; work done by hired labor, '89, 2054.

1889-'90. North pier extended 50 feet, and 4,147 cubic yards rock and 5,330 cubic yards sand removed by blasting and dredging; work done by hired labor, '90, 2338.

1890-'91. 200 linear feet of north pier superstructure built by hired labor; minor repairs to south pier, '91, 2539.

1891-'92. 352 linear feet of north pile pier provided with sheet piling; 652 cubic yards rock and 28,205 cubic yards sand and gravel dredged from the channel; all operations by hired labor, '92, 2185.

**Projects.**

The original project of 1870, by Maj. Houston, proposed the formation by pier extension and dredging, of an outer harbor covering the mouth of Ahnapee River; estimated cost, \$370,000, '71, 125; '72, 118; '76, ii, 351.

In 1873 the project was modified to provide for the formation of a small harbor at the mouth of the river, which might be subsequently utilized should the larger outer harbor ever be required; estimated cost, \$100,000, '73, 200; '76, ii, 351.

In 1875 Maj. Robert proposed the extension of the piers, provided for under the project of 1873, to the 18-foot curve in Lake Michigan, and the formation of an inner harbor 100 feet wide and 12 feet deep, extending from the highway bridge to the mouth of the river, at an estimated cost, in addition to the project of 1873, of \$95,000, or at an aggregate cost of \$175,000, '76, ii, 346-359; increased by Board of Engineers, '76, ii, 346.

In 1884 the project was modified by increasing the width of entrance to the piers to 200 feet, '85, 1990.

In 1891 the estimate of 1875 was increased by \$10,000, and \$9,000 was estimated as required for completion of the existing project, '91, 2539. Estimate for completion increased in 1892 to \$12,000, '92, 2185.

**Surveys.****MAPS.**

'88, 1846.

**ALABAMA RIVER, ALA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 13.)

**Appropriations.**

1878-'87 .....	\$145,000
1888 .....	20,000, '88, 1188.
1890 .....	20,000, '90, 1657.
1892 .....	70,000, '92, 1421.

Total .....

255,000

List of appropriations, '88, 1188; '91, 1738.

**Commerce.**

Present and prospective demands of commerce, '91, 1765.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 158; '89, 183; '90, 166; '91, 204, 211; '92, 200.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1187.

Capt. P. M. Price, 1889-'— Reports, '89, 1400; '90, 1654; '91, 1738; '92, 1418.

**ASSISTANT.**

C. B. Percy. Reports, '89, 1401; '90, 1635; '91, 1739, 1764, 1766; '92, 1419.

**ALABAMA RIVER, ALA.—Continued.****Operations.**

- 1887-'88. 1,333 logs and snags removed from the channel and 533 overhanging trees cut from the banks, '88, 1188  
 1888-'89. 2,200 logs and snags and one wreck removed from the channel; 4,730 trees and stumps removed from the banks.  
 1889-'90. 1,706 logs and snags removed from the channel; 4,111 trees and stumps removed from the banks; repairs to snagging plant, '90, 1656.  
 1890-'91. Snagging operations continued, '91, 1739.  
 1891-'92. 962 snags, 25 bowlders, 1,550 cubic yards gravel removed from the channel; 2,710 trees cleared from banks, and 181 linear feet of rock and brush jetty built, '92, 1420.

**Physical Characteristics.**

- Character of the banks and river bed, '89, 1400; '90, 1654; '91, 1761, 1762.  
 Condition of the channel at the various bars, islands, and shoals, from the mouth to the junction of the Coosa and Tallapoosa rivers, '91, 1768.

**Projects.**

- By Capt. Damrell, 1876, for the improvement of the river from its mouth, 50 miles above Mobile, to Wetumpka, Ala., a distance of 323 miles; by the removal of logs and snags, and by the construction of wing dams and jetties, so as to give a channel 200 feet wide and 4 feet deep at mean low water, at an estimated cost of \$229,741, '76, i, 498, 507; '85, 203.  
 In 1891, the project of 1876 having been practically completed at a cost of \$172,000, Capt. Price proposed increasing the channel depth to 6 feet, at an estimated cost of \$386,251, '91, 1740, 1765.

**Surveys.**

- Examination for a 6-foot channel from the mouth to Wetumpka, ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Price, '91, 1761.

**ALAFIA RIVER, FLA.—EXAMINATION OF.****Engineers.**

- CHIEF OF ENGINEERS.  
 Report, '89, 174.  
 ENGINEER IN CHARGE.  
 Capt. W. M. Black. Report, '89, 1357.  
 ASSISTANT.  
 D. B. Dunn. Report, '89, 1358.

**Physical Characteristics.**

- Description of the locality, '89, 1357.

**Plans.**

- By Capt. Black, 1889, for improvement of the river by carrying the channel depth at the mouth, 15 feet at low water, over the shoals as far as Peru, by dredging assisted by light wing dams; estimated cost, \$10,000, '89, 1358.

**Surveys.**

- Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Black, '89, 1357.

**ALEXANDER HARBOR, MO.—(See MISSISSIPPI RIVER FROM DES MOINES RAPIDS TO THE MOUTH OF THE ILLINOIS RIVER.)****ALLEGHENY RIVER, PA.—IMPROVEMENT OF**

(Continued from Vol. II, p. 14.)

**Appropriations.**

1879-'87 .....	{ \$135,000
	{ 37,500 *
1888 .....	{ 25,000, '88, 1680.
	{ 35,000, * '88, 1683.
1890 .....	{ 20,000, '90, 2195.
	{ 35,000, * '90, 2198.
1892 .....	{ 25,000, '92, 1995.
	{ 40,000, * '92, 1996.

Total..... 352,500

\* For dam at Herrs Island, '86, 1546; '87, 1812; '92, 1996.



**ALLEGHENY RIVER, PA.—Continued.****Contracts.**

1889. J. J. Shipman, for dike construction, at \$13,784, '89, 1886.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 216; '89, 251, 252; '90, 227; '91, 292; '92, 280.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. E. Merrill, 1876-'91. Reports, '88, 1680, 1682; '89, 1885, 1887; '90, 2194, 2198; '91, 2363, 2366.

Maj. A. Stickney, 1892-'— . Reports, '92, 1992, 1996.

**ASSISTANT.**

J. W. Arras. Reports, '88, 1681; '89, 1886, 1888; '90, 2194; '91, 2364, 2367; '92, 1992.

**Legal Proceedings.**

Work at Cornplanter Islands stopped by injunction, '90, 2195; removal of injunction secured by modification of plan, '91, 2364.

Commencement of operations on Herra Island Dam delayed by suit brought by riparian owners, '92, 1996.

**Operations.**

1887-'88. Dam at Corydon partially rebuilt, repairs to Six Mile and Nicholson's dams, and 540 tons rock removed from river bed, '88, 1680.

1888-'89. No operations, '89, 1885.

1889-'90. Repairs to dams at Six Mile and Nicholson's islands; 1,739 linear feet of timber and stone dike completed under contract at Red Bank, '90, 2194.

1890-'91. Dam at Cornplanter Islands completed; 50 linear feet of dam at Pithole built; 236 cubic yards rock used in repair of dike at Red Bank, '91, 2363.

Site prepared for lock-keeper's house at Herra Island, '91, 2366.

1891-'92. Dams at Hickory and Pithole completed; repairs to dike at Red Bank and dam at Nicholson's Island; 500 cubic yards rock removed from bar at foot of Pithole Ripple; 621 cubic yards rock and 11 snags removed between Kittanning and Pittsburg, '92, 1993, 1994.

**Projects.**

By Lieut. Col. Merrill, 1879, for the temporary improvement of the river by rock removal, construction of wing dams, closing low-water chutes behind islands, erection of a log chute in dam at Corydon Island, and repairs to dams at Nicholson's and Six-Mile islands, '79, 1371; '86, 273; '88, 1681.

In 1876 Lieut. Col. Merrill proposed the improvement of Garrisons Ripple at the head of Herra Island about 2 miles above the confluence of the Allegheny and Monongahela rivers, by construction of a lock and fixed dam at the head of the Allegheny arm of the pool formed by the Davis Island Dam; estimated cost, \$153,000, '76, ii, 148; '80, 1766; '86, 1545. In 1891 the authorities of Allegheny City donated the necessary land on the right bank on condition that the dam be made a movable one. The plans for the work were accordingly changed, increasing the estimated cost to \$600,000, '91, 2366.

**Surveys.**

Survey for location of Herra Island Lock and Dam. Made, 1889, under direction of Lieut. Col. Merrill, '89, 1888.

**ALLOUEZ (ALLONEZ) BAY AND NEMADJI RIVER, LAKE SUPERIOR, WIS.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 316.

**ENGINEERS IN CHARGE.**

Maj. J. B. Quinn. Report, '91, 2512.

Col. O. M. Poe. Report, '91, 2513.

**Physical Characteristics.**

Description of the locality, '91, 2513.

**Plans.**

In 1890 Col. Poe did not consider Nemadji River worthy of improvement, '91, 2512.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Quinn, '91, 2512.

**ALLOWAY CREEK, N. J.—IMPROVEMENT OF.****Appropriations.**

1890.....	\$6,000, '91, 1087.
1892.....	3,000, '92, 938.

Total.....	9,000
------------	-------

**Contracts.**

F. C. Somers, for dredging, at 18 cents per cubic yard, '91, 1087.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 1102; '90, 92; '91, 117; '92, 118.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1888-'91. Reports, '90, 906, 910.

Maj. C. W. Raymond, 1891-'— Reports, '91, 1086; '92, 937.

**ASSISTANT.**

L. Y. Schermerhorn. Report, '90, 907.

**Operations.**

1890-'91. 18,341 cubic yards material dredged, '91, 1086.

1891-'92. 4,893 cubic yards material dredged, '92, 937.

**Physical Characteristics.**

Description of the locality, '90, 907; '91, 1086.

**Projects.**

By Lieut. Col. Robert, 1889, for improvement of the creek by dredging a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above the Upper Hancock Bridge; from thence a channel of the same depth and a least width of 75 feet down the stream to the lower side of the bar at the Square.

At a locality in the creek known as the Canal, in addition to obtaining a channel of the dimensions named, the width of the creek is to be increased to about 150 feet between its low-water lines.

At the Square the dredged channel is to be supplemented by a deflecting dike 500 feet in length, formed of the dredged material, with its channel face protected by a riprap of stone. Estimated cost, \$25,000, '90, 913; '92, 937.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Robert, '90, 910.

**ALPENA HARBOR AND THUNDER BAY RIVER, MICH.—  
IMPROVEMENT OF.**

(Continued from Vol. II, p. 15.)

**Appropriations.**

1876-'82.....	\$19,500	
1890.....	{ Alpena Harbor.....	5,500 }
	{ Thunder Bay River..	10,000 }
1892.....	Thunder Bay River.	10,000, '92, 2453.

Total.....	45,000
------------	--------

**Contracts.**

1889. Carlin, Stickney & Cram, for dredging, at 40 cents per cubic yard, '89, 2246.

1891. Bay City Dredging Company, for dredging, at 19 cents per cubic yard, '91, 2767.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 262; '89, 310, 319; '90, 278; '91, 348, 350; '92, 335.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1883-'—. Reports, '88, 1961; '89, 2245, 2288, 2289; '90, 2722;

'91, 2765, 2768; '92, 2450, 2452.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1961.

1888-'89. 5,290 cubic yards material dredged, '89, 2286.

1889-'90. 5,254 cubic yards material dredged, '90, 2722.

1890-'91. 6,871 cubic yards material dredged from the harbor and 7,421 cubic yards from the river, '91, 2766, 2769.

1891-'92. 17,083 cubic yards material dredged from the harbor, 33,370 cubic yards material dredged from the river, '92, 2452.

## ALPENA HARBOR AND THUNDER BAY RIVER, MICH.— Continued.

### Physical Characteristics.

Description of the locality, '89, 2289.

### Projects.

By Maj. Harwood, 1881, for excavation of an entrance channel 14 feet deep from the bay into the river at an estimated cost of \$25,000, '81, 2244; '84, 2037. Project completed in 1884, '87, 2249.

In 1888 Col. Poe recommended the dredging of the partly deteriorated channel to 16 feet, at an estimated cost of \$34,511, '88, 1961; '91, 2765.

In 1889 Col. Poe proposed the improvement of Thunder Bay River by the excavation of a 16-foot channel, with a width varying from 50 to 200 feet, extending from the mouth to 1 mile above, involving the removal of 109,356 cubic yards of material, at an estimated cost of \$36,087.48, '89, 2290.

### Surveys.

Survey of Thunder Bay River, Alpena, Mich., for a 16-foot channel from the mouth to 1 mile above, ordered by act of August 11, 1888. Made, 1889, under direction of Col. Poe, '89, 2288.

### MAPS.

'89, 2290.

## ALSEA BAY AND RIVER, OREG.—EXAMINATION OF.

(Continued from Vol. II, p. 16.)

### Engineers.

#### CHIEF OF ENGINEERS.

Report, '91, 409.

#### ENGINEER IN CHARGE.

Capt. F. W. Symons. Report, '91, 3246.

#### ASSISTANT.

J. S. Polhemus. Report, '91, 3246.

### Physical Characteristics.

Description of the locality, '91, 3248.

### Plans.

In 1890 Capt. Symons did not consider the locality worthy of improvement, '91, 3249.

### Surveys.

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Symons, '91, 3246.

## ALTAMAHA RIVER, GA.—IMPROVEMENT OF.

(Continued from Vol. II, p. 16.)

### Appropriations.

1881-'87 .....	\$55,000
1888 .....	10,000, '88, 1038.
1890 .....	15,000, '90, 1371.
1892 .....	15,000, '92, 1263.

Total ..... 95,000

List of appropriations, '88, 1038.

### Commerce.

Increase in river trade and reduction in freight rates consequent upon improvement, '88, 1037; '90, 1382.

Value of lumber interests, '91, 1533.

### Contracts.

1888. M. A. Sweeney & Bro., for repairing snag boat, at \$10,000, '89, 1248.

### Engineers.

#### CHIEF OF ENGINEERS.

Reports, '88, 141; '89, 161; '90, 144; '91, 181; '92, 177.

#### ENGINEER IN CHARGE.

Capt. O. M. Carter, 1888-'—. Reports, '88, 1035; '89, 1245; '90, 1369, 1372; '91, 1531; '92, 1261.

#### ASSISTANTS.

W. R. Curtis. Report, '88, 1038.

F. C. Armstrong. Reports, '90, 1368; '91, 1535; '92, 1264.

**ALTAMAHA RIVER, GA.—Continued.****Operations.**

1887-'88. No operations, '88, 1036.

1888-'89. 157 snags and logs removed from the channel and 221 overhanging trees from the banks, '89, 1247.

1889-'90. 170 snags and logs removed from the river and 309 overhanging trees cut from the banks, '90, 1370.

1890-'91. 150 snags and 466 trees removed from the channel and banks, '91, 1532.

1891-'92. 521 snags removed from the channel and 1,100 overhanging trees cleared from the banks; construction of wattled pile spur dams begun at Beards Bluff, and repairs made to old training wall at that point, '92, 1262.

**Physical Characteristics.**

Description of the river, '90, 1372, 1374, 1378.

**Projects.**

By Col. Gillmore, 1880, for the formation of a low-water channel 80 feet wide and 3 feet deep, from its confluence to Darien, 155 miles, by the removal of rock, bars, and snags, at an estimated cost of \$60,000, '81, 1106; '87, 1176.

By Lieut. Carter, 1890, for the establishment of a navigable steamboat channel 3 feet deep at ordinary summer low water between the junctions of the Oconee and Ocmulgee rivers and the town of Darien; this to be accomplished by removal of rock shoals, sand bars, snags, and logs from the channel and overhanging trees from the banks, construction of deflecting dikes, closing incipient cut-offs, and revetting caving banks; total estimated cost, \$128,627.50, '90, 1370, 1380; '92, 1261.

**Surveys.**

Made under direction of Lieut. Carter, 1890, '90, 1372.

Examinations and surveys prior to 1890, '90, 1377.

**ALTON HARBOR, ILL.—(See MISSISSIPPI RIVER BETWEEN MOUTHS OF ILLINOIS AND OHIO RIVERS.)****ALVISO CREEK AND HARBOR, CAL.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 393.

ENGINEER IN CHARGE.

Lieut. Col. W. H. H. Benyaard. Report, '91, 2964.

**Physical Characteristics.**

Description of the locality, '91, 2964.

**Plans.**

In 1890 Lieut. Col. Benyaard did not consider the locality worthy of improvement, '91, 2964.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Benyaard, '91, 2964.

**AMITE RIVER AND BAYOU MANCHAC, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 17.)

**Appropriations.**

1880-'87 .....	\$15,000
1888.....	5,000, '88, 1248.
1889.....	3,800, '90, 1741.
1892.....	2,500, '92, 1488.

Total..... 26,300

List of appropriations, '92, 1488.

8648—2

**AMITE RIVER AND BAYOU MANCHAC, LA.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 168; '89, 196, 202; '90, 177; '91, 223; '92, 217.

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1247; '89, 1484, 1513, 1528; '90, 1740.

Maj. J. B. Quinn, 1891-'— . Reports, '91, 1820; '92, 1485.

**Operations.**

1887-'88. No operations, '88, 1247.

1888-'89. 846 trees and stumps removed from the channel and banks, '89, 1485.

1889-'90. No operations, '90, 1740.

1890-'91. Snagging operations resumed, '91, 1821.

1891-'92. 445 snags, logs, and trees cleared from the channel, '92, 1486.

**Plans.**

In 1888 Capt. Fisk considered the cost of improving Bayou Manchac as a water route from Mississippi River to Mississippi Sound excessive, '89, 1515.

**Projects.**

By Maj. Howell, 1879, for the improvement of the river from Bayou Manchac to Lake Maurepas, giving a low-water depth of 5 feet by the removal of snags and logs, at an estimated cost of \$23,760, '80, 1157. Improvement not considered permanent, '83, 1105; '84, 210.

After examination in 1889, Capt. Fisk reported the river as unworthy of improvement for more than 5 miles above the mouth of Bayou Manchac, and estimated such improvement, snagging, and dredging to cost \$5,000, '89, 1529. Improvement can not be made permanent, '91, 1821.

Annual expenditure of \$2,500 required to maintain the river and bayou in navigable condition, '92, 1486.

**Surveys.**

Examinations of Bayou Manchac for a water route from the Mississippi River to Mississippi Sound ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Fisk, '89, 1513.

Examination of Amite River ordered by act of August 11, 1888. Made under direction of Capt. Fisk, '89, 1528.

**ANDALUSIA, ILL.—(See MISSISSIPPI RIVER FROM ST. PAUL TO DES MOINES RAPIDS.)****ANNAPOLIS HARBOR, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 19.)

**Appropriations.**

1880-'81 ..... \$10,000

**Engineers.****ENGINEER IN CHARGE.**

Col. W. P. Craighill, 1876-'—. Report, '88, 761.

**ASSISTANT.**

C. P. E. Burgwyn. Report, '88, 762.

**Operations.**

1887-'88. No operations, '88, 761.

**Projects.**

By Col. Craighill, 1880, for improvement of the harbor by the formation of a channel through the bars abreast of the Naval Academy, by dredging to a width of 150 feet and depth of 24 feet low water; estimated cost, \$66,000, '81, 872; '85, 134.

In 1881 Col. Craighill recommended the postponement of operations as the amount available, \$10,000, was not sufficient to effect any substantial improvement, '81, 874.

**APALACHICOLA BAY, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 20.)

**Appropriations.**

1828-'87 .....	\$92, 350. 29
1888.....	20, 000. 00, '88, 1161.
1890.....	20, 000. 00, '90, 1624.
1892.....	20, 000. 00, '92, 1399.

Total..... 152, 350. 29

List of appropriations, '89, 1373; '91, 1694.

**Contracts.**

1889. Alabama Dredging and Jetty Company, for dredging, at 24½ cents per cubic yard, '89, 1374.

1891. Alabama Dredging and Jetty Company, for dredging, at 25 cents per cubic yard, '92, 1399.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 152; '89, 175; '90, 157; '91, 196; '92, 192.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1887-'89. Report, '88, 1160.

Capt. P. M. Price, 1889-'—. Reports, '89, 1372; '90, 1623; '91, 1694; '92, 1397.

**Operations.**

1887-'88. 7,688 cubic yards material dredged from the bar, '88, 1161.

1888-'89. No operations, '89, 1374.

1889-'90. 65,547 cubic yards mud and sand removed from the channel, '90, 1624.

1890-'91. No operations, '91, 1694.

1891-'92. 54,458 cubic yards material dredged, '92, 1398.

**Projects.**

By Capt. Damrell, 1879, for the formation, by dredging, of a channel 100 feet wide and 11 feet deep through the bar in the bay at the mouth of the river; estimated cost \$100,000, '79, 823; '85, 1258; '87, 1265.

It was not considered that the improvement would be permanent without auxiliary works, '80, 1077; '86, 193; '87, 1265.

In 1890, after the appropriation of \$107,000, it was estimated that \$40,000 would be required for completion, '90, 1624.

**Surveys.****MAPS.**

'90, 1624.

**APALACHICOLA RIVER, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 20.)

**Appropriations.**

1874-'87 .....	\$40, 500,
1888.....	2, 000, '88, 1160.
1890.....	2, 000, '90, 1622.
1892.....	5, 060, '92, 1401.

Total..... 49, 500

List of appropriations, '90, 1622; '91, 1696.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 151; '89, 175; '90, 156; '91, 197; '92, 193.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1887-'89. Report, '88, 1159.

Capt. P. M. Price, 1889-'—. Reports, '89, 1372, 1416; '90, 1621; '91, 1696; '92, 1400.

**ASSISTANT.**

T. Robinson. Reports, '89, 1418; '91, 1697.

**Operations.**

1887-'88. Improvement completed as projected, '88, 1160.

1888-'89. 304 logs and snags removed from the channel and 2,328 overhanging trees and logs removed from the banks, '89, 1372.

1889-'90. 366 logs and snags removed from the channel and 1,246 overhanging trees cut from the banks, '90, 1622.

1890-'91. 582 logs, snags, and stumps removed from the channel and 2,142 overhanging trees cleared from the banks, '91, 1697.

**APALACHICOLA RIVER, FLA.—Continued.****Operations—Continued.**

1891-'92. 313 snags cleared from the channel and 878 trees, logs, and stumps removed from the banks, '92, 1401.

**Physical Characteristics.**

Description of Chipola River tributary, '89, 1416.

**Projects.**

By Capt. Damrell, 1874, for the formation of a channel of navigable width and 6 feet depth by the removal of snags and overhanging trees, and by utilizing Styx River and Moccasin Slough, in avoiding the worst part of the Apalachicola River; estimated cost, \$80,000, '73, 698. Project accomplished in 1880 by expenditure of \$37,244, '80, 1076. In addition to original project, Chipola Cut-off opened to Whites Bluff, '82, 1265. Annual appropriations estimated for the preservation of improvement, \$2,000, '85, 1276; '86, 1154.

The act of August 11, 1888, directed an examination of the Chipola River from its mouth to Wewachitka and the cut-off and Lee Slough running from the Apalachicola to the Chipola River. This examination was made in 1889, and resulted in the recommendation that a channel 60 feet wide and 5 feet deep should be cleared through the cut-off, Lee Slough, and the Lower Chipola River, at an estimated cost of \$7,500, '89, 1417.

The present approved project, therefore, provides for securing a channel 100 feet wide and 6 feet deep, at low water, in the Apalachicola River by the removal of snags and overhanging trees, and widening and straightening Moccasin Slough and the Elbow, and for securing a channel through Lee Slough 60 feet wide and 5 feet deep at low water, by the removal of logs, snags, and overhanging trees, '91, 1696.

**Surveys.**

Examination of Chipola River from its mouth to Mariana ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Price, '89, 1416.

**MAPS.**

'91, 1697.

**APPOMATTOX RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 21.)

**Appropriations.**

1871-'87 .....	\$378, 750
1888 .....	15, 000, '88, 768.
1890 .....	15, 000, '90, 1025.
1892 .....	15, 080, '92, 1094.

Total ..... 423, 830

List of appropriations, '92, 1093.

**Contracts.**

1889. Cline & Isaac for jetty construction, '89, 953.

1890. W. Jameson, for construction of wattle jetty, at 79 cents per linear foot; timber jetty with mattress protection, at \$3.24; Dike A at \$1.06 and Dike B at 98 cents per linear foot, '91, 1302.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 101; '89, 118; '90, 106; '91, 150; '92, 152.

**ENGINEERS IN CHARGE.**

Col. W. P. Craighill, 1888-'90. Reports, '88, 768; '89, 955.

Lieut. G. J. Fiebeger, 1889-'92. Reports, '89, 952, 957; '90, 1025; '91, 1300.

Lieut. E. Burr, 1892-'—. Report, '92, 1093.

**Operations.**

1887-'88. Dredging carried on by the city of Petersburg, '88, 768.

1888-'89. 15,175 cubic yards material dredged, jetties repaired, and closure dike to Jetty No. 20 prolonged, '89, 952.

1889-'90. 10,435 cubic yards material dredged, '90, 1025.

1890-'91. 13,512 cubic yards of material dredged from Puddledock Shoal and deposited behind closure dike; 22 linear feet of jetty built; Rushmore Dam, etc., built, '91, 1301.

1891-'92. 892 linear feet of brush and pile dike built at Magazine Bend and at Lieutenant Run Dike, and 583 linear feet of the latter dike backed with brush; dam built at Steins Cut, and repairs to closure dike at head of Puddledock Cut; 7,867 cubic yards gravel used in construction of bank behind the cut, '92, 1093.

**APPOMATTOX RIVER, VA.—Continued.****Plans.**

By Lieut. G. J. Fiebeger, 1889, for diversion of the waters of the Appomattox River into the old North Channel, involving dredging, dam, embankment, and bridge construction, and the purchase of overflowed lands; estimated cost, \$387,926.21, '89, 960.

**Private and Corporate Work.**

Dredging done by the city, near Petersburg, '88, 768.

History of improvements carried on by the city of Petersburg, '89, 957, 961.

**Projects.**

By Board of Engineers, 1870, for the attainment of a channel with a depth of 12 feet at high water, and a width as great as the river will bear, the improvement to be accomplished by regulating works, aided by dredging; estimated cost, \$428,000, '71, 73, 606; '85, 155; '87, 117.

In 1887 a revision of the estimated cost for the completion of the project was \$33,810, '87, 978, 983. This was increased in 1889 to \$45,890, or \$30,080 for completion, '89, 953.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under Lieut. Fiebeger, '89, 957.

**MAPS.**

'89, 960.

**APPOQUINIMINK RIVER, DEL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 22.)

**Appropriations.**

1890.....	\$5,000, '91, 1161.
1892.....	5,000, '92, 951.

Total .....	10,000
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**Contracts.**

1891. F. C. Somers, for dredging at 19 cents per cubic yard, '91, 1162.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 112; '90, 102; '91, 121; '92, 121.

**ENGINEER IN CHARGE.**

W. F. Smith, United States agent, 1888-'92. Reports, '90, 943; '91, 1161; '92, 950.

**ASSISTANT.**

A. Stierle. Report, '90, 943.

**Operations.**

1890-'91. 24,981 cubic yards material dredged, '91, 1161

1891-'92. No operations, '92, 950.

**Physical Characteristics.**

Description of the locality, '90, 944.

**Projects.**

By Mr. W. F. Smith, 1889, for improvement of the creek by excavation of a channel 8 feet deep at mean low water, with a width of 80 feet, from the bridge at Odessa to Townsends Wharf, a distance of 3½ miles, and a width of 100 feet from this wharf to the mouth, a distance of 5 miles; estimated cost, \$39,963, '90, 947.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Mr. W. F. Smith, '90, 945.

**AQUIA (ACQUIA) CREEK, VA.—IMPROVEMENT OF.**

(Continued from Vol. I, p. 52.)

**Appropriations.**

1872.....	\$10,500
1890.....	10,000, '91, 1257.
1892.....	5,000, '92, 1044.

Total .....	25,500
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**AQUIA (ACQUIA) CREEK, VA.—Continued.****Commerce.**

Resources of the country tributary to Aquia Creek, '90, 1100.

**Contracts.**

1891. F. C. Somers, for dredging, at 12½ cents per cubic yard, '91, 1257.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 135; '90, 121; '91, 139; '92, 140.

**ENGINEERS IN CHARGE.**

S. T. Abert, United States agent, 1888-'91. Report, '90, 1096, 1097.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1255.

Maj. C. E. L. B. Davis, 1892-'— . Report, '92, 1042.

**Operations.**

1890-'91. 2,670 linear feet of channel dredged to full width of 80 feet and depth of 6 feet, '91, 1257.

1891-'92. Channel completed to the Richmond, Fredericksburg and Potomac Railroad bridge, '92, 1044.

**Physical Characteristics.**

Description of the locality, '90, 1100.

**Plans.**

By Mr. S. T. Abert, 1890, for improvement of the creek by excavation of a cut from Brents Point to the Narrows, 150 feet wide and 8 feet deep at the mouth of Austens Creek, with the construction of 100 linear feet of brush and pile dike; estimated cost, \$101,278, '90, 1102; '91, 1256.

**Projects.**

By Mr. S. T. Abert, 1890, for improvement of the creek by excavation of a channel 80 feet wide and 6 feet deep between the mouth and the Narrows; estimated cost, \$40,000, '90, 1097.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Mr. S. T. Abert, '90, 1097.

**ARANSAS PASS AND BAY, TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 22.)

**Appropriations.**

1879-'87.....	\$481,250
1888.....	100,000, '88, 1308.

Total.....	581,250
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List of appropriations, '90, 1811.

**Commerce.**

Trade of Corpus Christi, '89, 1567.

**Contracts.**

1887. A. M. Shannon & Co., for riprap, at \$2.95 per cubic yard, '88, 1308.

1888. Charles Clarke & Co., for riprap, at \$2.99 per cubic yard, '89, 1566.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 175; '89, 205; '90, 185; '91, 235.

**BOARD OF ENGINEERS.**

Convened at New York, July 19, 1887, to report upon the improvement of Aransas Pass. Report, '88, 1318. (Cols. Casey, Abbot, and Craighill; Lieut. Cols. Houston and McFarland, and Maj. King.)

**ENGINEERS IN CHARGE.**

Maj. O. H. Ernst, 1886-'90. Reports, '88, 1307, 1312; '89, 1564.

Maj. C. J. Allen, 1890-'—. Reports, '90, 1810; '91, 1942.

**ASSISTANTS.**

J. E. Savage. Report, '88, 1308.

G. Bagnall. Report, '89, 1566.

**Operations.**

1887-'88. Construction of protective works continued; 27,825 cubic yards riprap laid, protecting 1,895 linear feet of bank; 414,982 square feet of slope covered; 480 linear feet of spur dike built, '88, 1311.

1888-'89. 15,988 cubic yards riprap expended in protective works, covering 278,531 square feet of slope; 205 linear feet of spur built, '89, 1565.

1889-'90. Repairs to revetment at head of Mustang Island; further operations discontinued, '90, 1811.

**ARANSAS PASS AND BAY, TEX.—Continued.****Physical Characteristics.**

Tidal basin and volume of tidal prism at Aransas Pass; depths, surface widths, and areas of cross sections, '88, 1316.

Description of Aransas Bay, '91, 1942.

**Plans.**

In 1891 Maj. Allen did not consider the removal of Half Moon Reef in Aransas Bay a public necessity, '91, 1943.

**Projects.**

By Board of Engineers, 1879, for the formation and maintenance of a 12-foot channel at mean low water over the bar, by the extension of the north jetty from the end of St. Josephs Island, and the south jetty from the end of Mustang Island, and the construction of groins in conjunction with beach protection for the head of Mustang Island to and beyond Turtle Cove; estimated cost of jetties, groins, etc., \$759,185. The improvement of the interior channel from the Pass up to Rockport and Corpus Christi to be by dredging; estimated cost (by Maj. Howell), \$441,537.75, '80, 1247; '81, 1363; '85, 1465; '86, 1330; (by Cols. Tower and Newton and Lieut. Col. Gillmore) '80, 1271. In 1887, the work designed and partially executed having partially failed in obtaining the desired result at the Pass, Maj. Ernst proposed to abandon so much of the south jetty as curves northward, and by an easy change in direction to the southward to lead the jetty by the shortest line to deep water, the north jetty to be placed parallel to the outer end of the south jetty. For the protection of Mustang Island it is proposed to riprap its slope from high-water mark to bottom of the channel. The works proposed were expected to secure a channel at least 20 feet deep. Cost of revised project, \$2,052,543.72, '87, 1432.

Congress having, in 1890, granted to the Aransas Pass Harbor Company the right to improve the navigation of the Pass, further operations on the part of the Government were suspended, '90, 1811.

**Surveys.**

Made, 1887, under direction of Maj. Ernst, '88, 1312.

Examination of Aransas Bay, ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Allen, '91, 1942.

**ARCHERS HOPE RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 24.)

**Appropriations.**

1881-'82 ..... \$10,000

**Engineers:**

CHIEF OF ENGINEERS.

Report, '88, 101.

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1888-'— . Report, '88, 768.

**Operations.**

1887-'88. No operations since 1884, '88, 101.

**Projects.**

By Capt. Phillips, 1880, for the formation of a channel, by dredging, not less than 50 feet wide and 6 feet deep, extending from the mouth to Williamsburg, a distance of 5 miles, at an estimated cost of \$19,400, '80, 907; '85, 157; '87, 117.

**ARKANSAS RIVER, ARK. AND KANS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 24.)

**Appropriations.**

The appropriations for this river up to 1888 have been for the following subdivisions, viz:

Arkansas River, above Fort Smith, 1876-'86. ....	\$153,000
Arkansas River, at Fort Smith, 1884-'86. ....	18,000
Arkansas River, at Pine Bluff, 1880-'86. ....	131,500
Arkansas River, from Little Rock to mouth, 1884. ....	19,000
Arkansas River, 1888. ....	150,000, '88, 1385.
Arkansas River, 1890. ....	180,000, '90, 1939.
Arkansas River, 1892. ....	250,000, '92, 1680.

Total..... 901,500

**ARKANSAS RIVER, ARK. AND KANS.—Continued.****Commerce.**

Prospective advantages to commerce to result from completed improvement, '88, 1384, 1388; '90, 1937; '91, 2041.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 186; '89, 219; '90, 197; '91, 250; '92, 241.

**BOARD OF ENGINEERS.**

Convened at New York, March 16, 1888, to report upon improvement of the river from Wichita, Kans., to its mouth. Report, '88, 1389. (Cols. Casey and Abbot, Lieut. Cols. Comstock and Houston, and Maj. King.)

**ENGINEER IN CHARGE.**

Capt. H. S. Taber, 1884—'. Reports, '88, 1380, 1386; '89, 1647; '90, 1932; '91, 2037; '92, 1676.

**Operations.**

1887-'88. 2,594 linear feet of dike built between Little Rock and the mouth, '88, 1383.

1888-'89. Dike construction and repairs to existing dike at Pine Bluff; 2,000 linear feet of dike built at Dardanelle; spur dike built at Van Buren; dike construction at Baring Cross Bridge, and at and below Little Rock, '89, 1649.

1889-'90. Dike construction and repair at Pine Bluff; 1,500 linear feet of dike built above Fort Smith; 300 linear feet of dike built near Wilsons Rocks; construction of 3 dikes begun below Pine Bluff; 2 quarter boats and 10 barges built, '90, 1932.

1890-'91. 800 linear feet of dike built above Fort Smith and two dikes partially completed; 260 cubic yards rock removed at Morris Rocks; 3,257 linear feet of dike built below Pine Bluff; 10 barges built, and repairs made to plant, '91, 2040.

1891-'92. 800 linear feet of stone and brush dike completed above Fort Smith; 926 cubic yards rock excavated at Morris Rocks; 8,376 cubic yards rock quarried at Big Rock Stone Quarry; 300 linear feet of dike built at Pine Bluff; 1 mile of brush mattress, 125 to 150 feet wide, laid and riprapped below Pine Bluff; repair and construction of plant, '92, 1678.

**Plans.**

By Board of Engineers, 1888, for improvement of the river from Canadian River to its mouth, a distance of 1,409 miles, giving a navigable depth of 4 feet at mean low water by contraction work, shore protection, and removal of obstructions; estimated cost, \$16,360,000, '88, 1400.

**Projects.**

In 1878 Maj. Suter proposed for the improvement of the river at Fort Smith a brush and stone dike 1,100 feet long, extending from the left bank and near the mouth of Poteau River; this work was completed in 1879 at a cost of \$19,695, '78, 658; '79, 1082; '85, 1563.

In 1879 Maj. Suter proposed an improvement between Fort Smith and Wichita Bar by removal of snags, rock, and other obstructions between the above limits; estimated cost, \$100,000, '79, 1081, 1088; '81, 215.

By Maj. Suter, 1880, for the improvement of the river in the vicinity of Pine Bluff, by the protection of the river bank from erosion, the rectification of the river just above, and the prevention of a cut-off across the peninsula opposite Pine Bluff; estimated cost, \$100,000, '80, 1468, 1470. Failure of project, '84, 1396; '85, 1565; '87, 1515.

In 1881 Maj. Adams proposed repairing a few small dikes built by private enterprise, '84, 1397; '85, 1563.

In 1884, to prevent the threatened destruction of the city front, two deflecting dikes of piles, brush, and sand boxes were built, the upper dike 1,520 feet and the lower dike 251 feet long; the works were entirely successful, and cost about \$49,000, '85, 1567, 1571, 1581.

By Capt. Taber, 1885, for the permanent improvement of the river from Little Rock to its mouth, contemplating a channel at least 200 feet wide and 6 feet deep at low water, by the contraction and regulation of the channel; estimated cost, \$2,538,544, '85, 1603; '87, 1524.

In the general improvement of the river as proposed in 1885, special works of protection and contraction were provided for at Pine Bluff, Fort Smith, and Dardanelle, '88, 1380, 1381.

In 1889 the amount required for completion was increased from \$2,344,544 to \$3,651,479, '89, 1651; '92, 1679.

**Surveys.****MAPS.**

'90, 1934; '92, Atlas, 83, 84, 85.

**ARKANSAS RIVER.—REMOVING SNAGS AND WRECKS FROM.**

(Continued from Vol. II, p. 25.)

**Appropriations.**

1832-'87 .....	\$295, 875
1888 .....	25, 000, '88, 1880.
1890 .....	20, 000, '90, 1931.
1892 .....	20, 000, '92, 1675.

Total ..... 360, 875

**Commerce.**

Prospective advantages from completion of improvement, '88, 1379; '89, 1646; '91, 2036.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 185; '89, 218; '90, 196; '91, 249; '92, 241.

**ENGINEER IN CHARGE.**

Capt. H. S. Taber, 1884-'— Reports, '88, 1378; '89, 1643; '90, 1928; '91, 2033; '92, 1673.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1379.

1888-'89. Reconstruction of snag boat *Wichita*, '89, 1644.

1889-'90. 552 snags and 231 overhanging trees removed, '90, 1929.

1890-'91. 300 snags removed from the channel, 2,000 trees cut, and 13,000 trees deadened upon the banks, '91, 2034.

1891-'92. 787 snags removed, 544 overhanging trees cut away, and 4 drift piles destroyed, '92, 1674.

**ARTHUR KILL, NEW YORK AND NEW JERSEY.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 28.)

**Appropriations.**

1888 .....	\$10, 000, '89, 820.
1890 .....	7, 000, '90, 843.
1892 .....	5, 000, '92, 870.

Total ..... 22, 000

**Contracts.**

1890. R. G. Packard, for dredging, at 23½ cents per cubic yard, '90, 844.

1891. Atlantic Dredging Company, for dredging, at 24½ cents per cubic yard, '91, 985.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 86; '90, 76; '91, 97; '92, 100, 398.

**BOARD OF ENGINEERS.**

Convened at New York City, May 20, 1892, by Special Order No. 49, to consider the modification of the pier-head line established March 4, 1890, on Arthur Kill in front of Perth Amboy. Report, '92, 861. (Cols. Abbot, Craighill, and Houston, and Lieut. Col. Gillespie.)

**ENGINEER IN CHARGE.**

Capt. T. L. Casey, 1889-'— Reports, '89, 819; '90, 843; '91, 983; '92, 869.

**Operations.**

1888-'89. No operations, '89, 820.

1889-'90. 29,000 cubic yards material dredged, '90, 844.

1890-'91. 22,000 cubic yards material dredged, '91, 984.

1891-'92. No operations, '92, 869.

**Projects.**

By Capt. Casey, 1888, for removal of a point of land near the Staten Island Bridge, for the purpose of straightening the channel, and facilitating the passage of long tows through the drawspan of the bridge; estimated cost, \$26,500, '89, 86, 820.

**Surveys.****MAPS.**

'89, 820; '90, 844.

# **ASHEPOO RIVER, S. C., BELOW THE CHARLESTON AND SAVANNAH RAILROAD BRIDGE.—EXAMINATION OF.**

## **Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 158.

ENGINEER IN CHARGE.

Capt. F. V. Abbot. Report, '89, 1216, 2796.

## **Obstructions.**

Bridge obstructing navigation, '89, 2796.

## **Plans.**

In 1888 Capt. Abbot did not consider that the commercial interests involved warranted any expenditure for improvement on the part of the Government, '89, 1218.

## **Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Abbot, '89, 1216.

# **ASHLAND HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 28.)

## **Appropriations.**

1886-'87 .....	\$22,500
1888 .....	60,000, '88, 1818.
1890 .....	60,000, '90, 2296.
1892 .....	45,000, '92, 2139.

Total ..... 187,500

List of appropriations, '90, 2296

## **Commerce.**

Increase in staple exports, '89, 2016; '90, 2296.

## **Contracts.**

1889. Hugh Steele, for breakwater construction, at \$11.45 per running foot, '89, 2017.

1891. H. Steele, for breakwater construction, at \$25.95, and brush and stone dike construction, at \$6.25 per running foot, '91, 2501.

## **Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 233; '89, 270; '90, 244; '91, 313; '92, 299.

ENGINEERS IN CHARGE.

Maj. C. E. L. B. Davis, 1887-'89. Report, '88, 1817.

Maj. J. B. Quinn, 1889-'91. Reports, '89, 2015; '90, 2295.

Capt. W. L. Fisk, 1891-'—. Reports, '91, 2500; '92, 2137.

## **Operations.**

1887-'88. Suspension of, in 1887, '88, 1818.

1888-'89. 100 linear feet of breakwater built, '89, 2015.

1889-'90. 4,550 linear feet of breakwater built, '90, 2295.

1890-'91. Extension of breakwater in progress under contract, '91, 2500.

1891-'92. Breakwater completed to a total length of 5,680 feet; breach in Chequamegon Point closed by a brush and stone dike 4,200 feet long; repairs to the old portion of the breakwater, '92, 2138.

## **Plans.**

By Lieut. Col. Barlow, 1885, for the construction of a pile and slab breakwater, about 8,000 feet in length, located about 2 miles northeast of the present ore dock, at an estimated cost of \$132,377, and the removal, by dredging to a depth of 12 feet, of the shoal in front of Mueller & Ritchie's Wharf, at an estimated cost of \$10,000, '85, 2013; '86, 1675.

## **Projects.**

By Board of Engineers, 1887, for improvement of Ashland Harbor by closing the breach in Chequamegon Point with a pile revetment 4,300 feet long, and by dredging a channel 100 feet wide and 18 feet deep in front of and touching the principal wharves of the city, with a semicircular turning basin of 400 feet radius; estimated cost, \$83,540, '87, 1966; '88, 1817, 1818. This project was abandoned in 1889, at the request of the citizens of Ashland, and a new project was submitted by Maj. Quinn and approved by the Board of Engineers. This provided for dredging a channel along the piers 200 feet wide and 17 feet deep, and the construction of 4,650 linear feet of breakwater projecting into the bay in such a manner as to protect the wharves from wave action; the inner end of the breakwater to be 1,000 feet outside of the established dock line. Estimated cost, \$247,967.50, '89, 2015, 2016.

**ASHLAND HARBOR, WIS.—Continued.****Projects—Continued.**

In 1890, after completion of the breakwater as projected, the project was modified to provide for the excavation of the channel along the wharves at an estimated cost of \$103,125, '90, 2295, 2296; also the construction of 2,320 linear feet of breakwater extension, making the total estimated cost for completion of proposed improvements in 1891, \$187,500, '91, 2500; '92, 2138.

**Surveys.****MAPS.**

'89, 2016.

**ASHLEY RIVER, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 29.)

**Appropriations.**

1880-'87 ..... \$5,500

List of appropriations, '88, 984; '91, 1477.

**Commerce.**

Commerce of the river, '88, 984.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 136; '89, 151; '90, 136; '91, 176; '92, 174.

**ENGINEER IN CHARGE.**

Capt. F. V. Abbot, 1888-'—. Reports, '88, 983; '89, 1166; '90, 1205; '91, 1476; '92, 1229.

**Operations.**

1887-'92. No operations, the desired channel depth having been secured, '88, 983; '89, 1166; '90, 1205; '92, 1230.

**Projects.**

By Lieut. Col. Gillmore, 1873, for the formation of a dredged channel 11 feet deep at mean low water across shoals of Accabee and the Wando Phosphate Works, at an estimated cost of \$5,000, '73, 756; '86, 179; '87, 1141.

**Surveys.**

Stadia survey of upper river, '88, 983.

**ASHTABULA HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 29.)

**Appropriations.**

1826-'87 ..... \$403, 168. 22

1888 ..... 25, 000. 00, '88, 2014.

1890 ..... 40, 000. 00, '90, 2786.

1892 ..... 70, 000. 00, '92, 2510.

Total ..... 538, 168. 22

List of appropriations, '92, 2509.

**Commerce.**

Increase in tonnage from 1884 to 1890, '91, 2864.

**Contracts.**

1888. Carlin, Stickney & Cram, for rock excavation, at \$1.90 per cubic yard, '89, 2332.

B. S. Horton, for pier extension and repair, at a total of \$8,920, '89, 2333.

1890. Q. Gillmore, for pier extension and repair, at a total of \$9,733.12, '90, 2783.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 276; '89, 327; '90, 296; '91, 372; '92, 351.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1885-'92. Reports, '88, 2013; '89, 2329; '90, 2783; '91, 2863.

Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2508.

**Operations.**

1887-'88. 12,731 cubic yards material dredged, '88, 2013.

1888-'89. 2,414 cubic yards material dredged; extension of east pier and repairs to both piers begun, '89, 2330.

**ASHTABULA HARBOR, OHIO—Continued.****Operations—Continued.**

1889-'90. 2,800 cubic yards material dredged; extension of east pier completed, '90, 2784.

1890-'91. 2,957 cubic yards ledge rock and 4,101 cubic yards loose rock, sand, and gravel removed from the channel, '91, 2864.

1891-'92. 24,000 cubic yards material dredged, '92, 2509.

**Projects.**

By Lieut. Col. Wilson, 1880, for the further extension of the piers to the 16-foot curve, with the removal of 1,100 linear feet of old west pier, revetting the river bank, and the removal by dredging of 20,000 cubic yards of material, at an estimated cost of \$88,000, '80, 2163. In 1882 Lieut. Col. Wilson estimated that \$62,000 will be required, in addition to the \$60,000 appropriated since 1880, to complete the work, '82, 2410. Lieut. Col. Wilson does not deem it possible to maintain a depth at entrance to pier of 16 feet without continual dredging, '82, 2411.

In 1883 Maj. Adams increases the foregoing estimate to \$91,800, '83, 1918.

In 1884 Maj. Maguire increased previous estimate to \$102,750, '84, 2117; '85, 342.

In 1890 Maj. Overman proposed securing 20 feet depth by extension of the piers to the 22-foot curve in the lake, involving the construction of 1,360 linear feet of pier, with repairs to existing works; estimated cost, \$265,650, '90, 2785.

In 1891 Maj. Overman proposed the removal of 242 linear feet of the lake and of the east pier and relocation of the same 45 feet to the eastward of its present position, with additional rock excavation as required by such change of pier; estimated cost, \$23,492, making the total cost of revised and approved project \$329,142, '91, 2864.

**Surveys.****MAPS.**

'91, 2866.

**ATCHAFALAYA RIVER, LA.—EXAMINATION OF.**

(Continued from Vol. II, p. 31.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 202.

**ENGINEER IN CHARGE.**

Capt. W. L. Fisk. Report, '89, 1510.

**Plans.**

In 1888 Capt. Fisk did not consider that the existing commercial requirements demanded any expenditure for improvement of the river, '89, 1511.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Fisk, '89, 1510.

**ATCHISON, KANS.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****ATLANTIC CITY HARBOR, N. J.—SURVEY OF.**

(Continued from Vol. II, p. 31.)

**Appropriations.**

1886..... \$5,000

**Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 85.

**ENGINEER IN CHARGE.**

Lieut. Col. H. M. Robert. Report, '88, 717.

**AU GRES RIVER, MICH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 319.

ENGINEER IN CHARGE.

Col. O. M. Poe. Report, '89, 2277.

**Plans.**

In 1888 Col. Poe did not consider that the present or prospective commerce of the river warranted the considerable expenditure that would be required for improvement, '89, 2278.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2277.

**AU SABLE RIVER AND HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 32.)

**Appropriations.**

1867-'82 ..... \$113,970

List of appropriations, '92, 2454.

**Contracts.**

1889. Carlin, Stickney &amp; Cram, for dredging, at 34½ cents per cubic yard, '89, 2248.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 263; '89, 311, 319; '90, 279; '91, 351; '92, 336.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1883-'—. Reports, '88, 1962; '89, 2247, 2279; '90, 2723; '91, 2771; '92, 2453.

**Operations.**

1887-'89. No operations; condition of harbor; past work, '88, 1962; '89, 2248.

1889-'90. 12,864 cubic yards material dredged, '91, 2724.

1890-'92. No operations, '91, 2771; '92, 2453.

**Plans.**

Col. Poe, after examination, reports the harbor of Au Sable as unworthy of improvement by the General Government, '89, 2280.

**Projects.**

By Maj. Reynolds, 1866, for the extension of the piers to the 12-foot curve, and dredging for the formation of a channel to that depth; estimated cost, \$114,754, '66, iv, 77, '85, 2133. Modified in 1867 by Col. Cram, to provide a channel 10 feet deep in place of 12; estimated cost, \$82,893, '67, 147; '85, 2133. After the expenditure of appropriations aggregating \$95,970, Maj. Harwood, in 1879, proposed, at an estimated cost of \$35,000 for the completion of the improvement, the formation of a channel 10 feet deep and 100 feet wide, extending from deep water in the lake to the State Street Bridge in Au Sable (S. Ex. Doc. 79, Forty-fifth Congress, third session), '79, 1657. Estimated in 1883 by Maj. Farquhar, \$32,121, '83, 1857.

In 1885 Col. Poe considered that the formation of the bar at entrance to the harbor precluded its improvement at a cost commensurate with the advantages to be gained, '85, 2130; '86, 322. Expenditures have resulted in a depth of 4 feet on the bar and 8 feet in the channel from bar to Oscoda Bridge, '85, 2137.

In 1891 Col. Poe did not recommend any further attempts to secure a permanent improvement, '91, 2771.

**Surveys.**

Examination of Au Sable River for a 12-foot channel and breakwater, ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2279.

**AUX BECS SCIES, MICH.—(See FRANKFORD HARBOR, MICH.)**



**BALTIMORE HARBOR, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 34.)

**Appropriations.**

1886-'87 .....	\$2, 271, 830
1888 .....	300, 000, '88, 756.
1890 .....	340, 000, '90, 988.
1891 .....	151, 200, '91, 1229.
1892 .....	{ 28, 000*
	208, 000, '92, 1007.

Total ..... 3, 299, 030

List of appropriations, '92, 1007.

**Commerce.**

Commercial interests of Baltimore, '89, 929, 934; '90, 989.

**Contracts.**

1888. American Dredging Company, for dredging, at 11 cents per cubic yard, '89, 928.

1889. American Dredging Company, for dredging, at 11½ cents per cubic yard, '89, 929.

1890. American Dredging Company, for dredging, at 10½ cents per cubic yard, '91, 1229.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 95; '89, 113; '90, 102; '91, 132; '92, 132.

ENGINEERS IN CHARGE.

Col. W. P. Craighill, 1870-'89. Report, '88, 756.

Capt. T. Turtle, 1889-'90. Report, '89, 927.

Col. W. P. Craighill, 1890-'—. Reports, '90, 987; '91, 1227; '92, 1006.

**Operations.**

1887-'88. No operations for lack of funds, '88, 756.

1888-'89. 200,000 cubic yards material dredged, '89, 928.

1889-'90. No operations, '90, 987.

1890-'91. 1,334,000 cubic yards material dredged from the channel, '91, 1228.

1891-'92. 3,506,443 cubic yards material dredged from the channel, '92, 1006.

**Private and Corporate Work.**

\$500,000 expended in work of improvement by the city of Baltimore and the State of Maryland, up to 1890, '91, 133.

**Projects.**

From 1836 to 1838, inclusive, \$55,000 was appropriated for Baltimore Harbor, '66, iii, 36.

In 1852 the project originated for improving the channels at the approach from deep water in Chesapeake Bay, and was inaugurated under the joint action of the Government and State of Maryland in the improvement of the Brewerton Channel to a width of 150 feet and a depth of 22 feet, '67, 420; '70, 418; '74, ii, 19; '79, 492.

In 1866 Maj. Craighill proposed an alteration in the direction of a part of the channel, with a widening of the channels to 200 feet, '66, iv, 233, 234; '67, 42, 417, 420, 422.

In 1872 the project was revised to provide for channels 24 feet deep at mean low water and from 250 to 400 feet wide, '72, 67; '73, 761; '74, 221.

In 1881 Lieut. Col. Craighill proposed the deepening of the channels to 27 feet at mean low water, together with the formation of a cut-off between the lower part of the Brewerton and the upper part of the Craighill channels, '81, 861. This work was practically accomplished in 1886, '86, 874.

The total amount appropriated from 1852 to 1886, inclusive, was \$2,216,830.

By Col. Craighill, 1887, for improvement of the channels between deep water in Chesapeake Bay and Baltimore, by dredging the same to 27 feet mean low water, and 600 feet width; estimated cost, \$1,300,000, '87, 860, 881; '88, 756.

Amount estimated for completion in 1891, \$208,800, '91, 134.

**BANGOR HARBOR AND PENOBSCOT RIVER, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 35.)

**Appropriations.**

1829-'87 .....	\$213, 300
1888, Bangor Harbor .....	20, 000, '88, 380.
1888, Penobscot River .....	50, 000, '89, 514.

\*Appropriated for Curtis Bay Channel.

**BANGOR HARBOR AND PENOBSCOT RIVER, ME.—Continued.****Appropriations—Continued.**

1890, Bangor Harbor and Penobscot River.... \$25,000, '90, 434.  
 1892, Bangor Harbor and Penobscot River.... 40,000, '92, 507.

Total ..... 348,300  
 List of appropriations, '89, 512; '92, 505.

**Commerce.**

Statistics of ports of Bangor, Winterport, and Bucksport, '87, 444, 445.  
 Railway connections with navigable portions of the river, '88, 380.  
 Shipping of Bangor, '88, 426.

**Contracts.**

1889. T. Symonds, for dredging, at 30 cents per cubic yard, '89, 514.  
 1890. J. B. Johnston, for dredging, at 17 cents per cubic yard, '90, 434.  
 1891. A. K. Stone, for dredging, at 26½ cents per cubic yard, '92, 506.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 13, 22; '89, 22; '90, 17; '91, 23, 33; '92, 27, 39.

**BOARD OF ENGINEERS.**

Convened January, 1889, at New York City, to examine and report upon Lieut. Col. Smith's project for the improvement of the Penobscot River between Bucksport and Winterport, Me.; letter, '89, 517. Report, '89, 520. (Cols. Abbot and Comstock, and Lieut. Cols. Houston and Gillespie.) Report, '89, 517, 520.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'92. Reports, '88, 379, 425, 427; '89, 512, 513, 516, 518, 519; '90, 434; '91, 579; '92, 534.  
 Lieut. Col. P. C. Hains, 1892-'— Report, '92, 504.

**ASSISTANT.**

A. C. Both. Reports, '88, 428; '89, 515; '92, 539.

**Operations.**

1887-'88. 14,102 cubic yards material dredged and 9½ cubic yards stone removed from the channel at Bangor Harbor, '88, 380.  
 1888-'89. 37,822 cubic yards material dredged and 22½ cubic yards bowlders removed from Bangor Harbor Channel, '89, 512.  
 1889-'90. Bangor Harbor Channel completed as projected; 137,343 cubic yards material dredged from the Penobscot River between Bangor and Bucksport Narrows, '90, 433.  
 1890-'91. 65,460 cubic yards material dredged above Crosbys Narrows and at Frankford Flats, '91, 580.  
 1891-'92. 12,000 cubic yards material dredged from river near Sterns Mills, '92, 506.

**Physical Characteristics.**

Current observations and borings, '88, 429, 430, 515, 516.

**Projects.**

For projects previous to 1884 see Penobscot River, Me.

The project of 1884 proposed, by dredging, to widen the channel opposite Bangor to a width of 300 feet with a low-water depth of 11 feet; also to widen, straighten, and deepen the channel near Crosbys Narrows; estimated cost, \$75,000, '84, 477; '86, 531.

By Lieut. Col. Smith, 1888, for improvement of the river between Bangor and Bucksport Narrows, contracting the cross section of the river at various points by means of stone jetties, to secure a channel 800 feet wide and 22 feet deep at mean low water through the shoals, the action of the jetties to be assisted by dredging; estimated cost, \$365,000, '88, 430, 431; '89, 516. Total estimated cost of project for the improvement of Bangor Harbor and Penobscot River, \$440,000, '90, 433; '92, 504.

In 1891 Lieut. Col. Smith proposed the construction of a rubble stone jetty to assist in maintaining the channel at Frankford Flats; estimated cost, \$46,200, '91, 584.

By Lieut. Col. Smith, 1891, for widening the channel at Bangor and dredging at ferry landings; construction of two stone jetties at Crosbys Narrows, and three jetties between Bucksport and Winterport; estimated cost, \$202,000, '92, 538.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Lieut. Col. Smith, '88, 427.

Survey of Penobscot River. Made, 1891, under direction of Lieut. Col. Smith, '92, 535.

**MAPS.**

'89, 516.

**BAR HARBOR, ME., with a view to establishing a breakwater and deepening the channel between Rodicks and Mount Desert Islands.**

(Continued from Vol. II, p. 36.)

**Appropriations.**

1888.....	\$50,000, '88, 13.
1890.....	50,000, '90, 431.
1892.....	50,000, '92, 501.

Total ..... 150,000

**Contracts.**

1889. F. S. Andrews, for furnishing and placing stone on Bar Harbor Breakwater, at \$1.10 per ton, '89, 511.  
 1890. T. R. Smith, for furnishing and placing stone on Bar Harbor Breakwater, at \$1.23½ per ton, '91, 578. Contract annulled, '92, 501.  
 1892. W. S. White, for riprap breakwater construction at \$1.02 per ton, '92, 501.  
 G. M. Neelon, for riprap breakwater construction, at \$1.23½ per ton, '92, 501.

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '88, 13; '89, 21; '90, 16; '91, 21; '92, 25.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1887-'92. Reports, '89, 509; '90, 430; '91, 578.  
 Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 500.

**Operations.**

- 1887-'89. No operations, '88, 13; '89, 510.  
 1889-'90. 11,393 tons of stone delivered in breakwater, '90, 431.  
 1890-'91. 6,127 tons of stone delivered in the breakwater, '91, 577.  
 1891-'92. Construction of breakwater continued, '92, 501.

**Projects.**

- By Lieut. Col. Smith, for construction of riprap breakwater, with concrete superstructure, extending from Round Porcupine Island to Porcupine Dry Island, and thence to within 400 feet of the shore line, a total distance of 3,425 feet; estimated cost, \$500,000, '87, 484. Revised in 1889 to \$800,000, '89, 510.  
 Increased in 1891 to \$806,000, '91, 577.

**Surveys.**

**MAPS.**  
 '91, 576.

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**BARREN RIVER, KY.—(See GREEN AND BARREN RIVERS.)**

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**BARNEGAT AND GREAT EGG HARBOR BAYS, N. J.—EXAMINATION OF SOUND BETWEEN.**

**Engineers.**

**CHIEF OF ENGINEERS.**

Report, '91, 118.

**ENGINEER IN CHARGE.**

Maj. C. W. Raymond. Report, '91, 1094.

**Physical Characteristics.**

Description of the locality, '91, 1094.

**Plans.**

In 1890 Maj. Raymond did not consider the sound worthy of improvement, '91, 1094.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Raymond, '91, 1094.

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**BATON ROUGE HARBOR, LA.—EXAMINATION OF.**

**Engineers.**

**CHIEF OF ENGINEERS.**

Report, '89, 202.

**ENGINEER IN CHARGE.**

Capt. W. L. Fisk. Report, '89, 1511.

**BATON ROUGE HARBOR, LA.—Continued.****Plans.**

In 1889 Capt. Fisk reported the present harbor facilities as sufficient for existing commercial requirements, '89, 1511.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Fisk, '89, 1511.

**BAY RIDGE CHANNEL, N. Y.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 94.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie. Report, '91, 940.

**Plans.**

In 1890 Lieut. Col. Gillespie did not consider the locality worthy of improvement to the extent desired, '91, 942.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Gillespie, '91, 940.

**BAYADUCE (BAGADUCE) RIVER, ME., BETWEEN THE TOWNS OF PENOBSCOT AND BROOKSVILLE.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 37.)

**Appropriations.**

1888.....	\$3, 000, '89, 511.
1890.....	4, 000, '90, 432.
1892.....	5, 000, '92, 503.

Total ..... 12, 000

**Commerce.**

Industries to be stimulated by increased channel facilities, '88, 400.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 13, 22; '89, 21; '90, 17; '91, 22; '92, 26.

ENGINEERS IN CHARGE.

Lieut. Col. J. A. Smith, 1888-'92. Reports, '88, 398; '89, 511; '90, 432; '91, 578.

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 502.

ASSISTANT.

F. S. Burrowes. Report, '88, 402.

**Operations.**

1887-'91. No operations; work postponed to await further appropriations, '88, 398; '89, 512; '90, 432; '91, 579; '92, 503.

**Physical Characteristics.**

Character and dimensions of the natural channel from the mouth to Penobscot, '88, 399.

**Projects.**

By Lieut. Col. Smith, 1888, to straighten and deepen the channel by dredging and rock removal, giving a width of 150 feet from Bridges Point to Winslows Island, and thence a width of 100 feet to the village of South Penobscot, with a depth of 6 feet at low water throughout; estimated cost, \$45,000, '88, 399, 402; '92, 502.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Lieut. Col. Smith, '88, 401.

**BAYOU BARTHOLOMEW, ARK. AND LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 38.)

**Appropriations.**

1881-'87 .....	\$23,000
1888.....	5,000, '88, 1352.
1890.....	5,000, '90, 1884.
1892.....	5,000, '92, 1613.

Total ..... 38,000

List of appropriations, '91, 1983.

**Commerce.**

Cotton trade of the bayou, and reduction in freight rates thereon, '90, 1884; '91, 1983.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 179; '89, 210; '90, 189; '91, 240; '92, 232.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1886-'—. Reports, '88, 1351; '89, 1601; '90, 1882; '91, 1982; '92, 1610.

**Operations.**

1887-'88. 3,460 logs and snags removed from the channel, 3,126 trees, and 8,653 square yards brush cut from the banks, '88, 1351.

1888-'89. No operations, '89, 1601.

1889-'90. 10,500 snags and 3 wrecks removed from the channel; 49,650 trees, 6,500 shore snags, and 9,325 square yards brush cut from the banks, '90, 1883.

1890-'91. 1,670 snags removed from the channel, 10,852 stumps and logs removed from the channel and banks, and 44,600 trees girdled and removed, '91, 1984.

1891-'92. 3,470 snags and stumps removed; 10,105 shore snags and logs and 41,054 trees cleared from the banks, '92, 1612.

**Projects.**

By Maj. Benyaud, 1880, for the improvement of the bayou from Baxter Station to its mouth, a distance of 213 miles, by the removal of trees, logs, and snags; estimated cost, \$26,862, '81, 1455.

No permanent improvement can be effected, '85, 235.

**BAYOU BLACK, LA. —IMPROVEMENT OF.**

(Continued from Vol. II, p. 39.)

**Appropriations.**

1881-'84 .....	\$25,000
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**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 229, 230.

ENGINEER IN CHARGE.

Capt. W. L. Fisk, 1888-'—. Reports, '88, 1251; '91, 1846, 1850.

**Operations.**

Operations prior to 1888, '88, 1251.

1887-'88. No operations for lack of funds, '88, 1252.

**Physical Characteristics.**

Description of the bayou, '88, 1251.

**Plans.**

In 1890 Capt. Fisk did not consider Bayou Black worthy of improvement, either in connection with Bayou Terrebonne or as a connection between Calcasieu and Sabine lakes, '91, 1846, 1851.

**Projects.**

The project under which operations were carried on up to 1886 was by Maj. Howell, 1881, and provided for cleaning the bayou of obstructions and dredging a channel 59 feet wide and 6 feet deep from Bayou Cane to Tigerville, 24 miles; estimated cost, \$47,520, '81, 1288, 1292. Increased in 1885 to \$81,000, '85, 1402; '87, 1369. In 1887, Maj. Heuer considered the improvement of the bayou local in its benefits, '87, 1370.

**Surveys.**

Examination of Bayou Black to connect with Bayou Terrebonne ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Fisk, '91, 1846.

Examination of Bayou Black for connection between Calcasieu Lake and Sabine Lake ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Fisk, '91, 1851.

**BAYOU BOEUF, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 40.)

**Appropriations.**

1881-'87 .....	\$20,000
1888 .....	6,000, '88, 1354.
1890 .....	5,000, '90, 1887.
1892 .....	10,000, '92, 1616.

Total ..... 41,000

List of appropriations, '91, 1986.

**Contracts.**

1888. A. Hefner, for earth filling, at 22 cents per cubic yard, '88, 1353.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 179; '89, 211; '90, 190; '91, 241; '92, 233.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1886-'—. Reports, '88, 1353; '89, 1603; '90, 1885; '91, 1985; '92, 1614.

ASSISTANT.

J. Ewens. Report, '91, 1986.

**Operations.**

1887-'88. Closure of Outlet No. 1 completed, '88, 1353.

1888-'89. Closure of Outlets 2 and 3 completed by deposit of 14,860 cubic yards of earth; 3,000 snags removed from channel, and 7,440 trees and 3,770 square yards brush cleared from the banks, '89, 1603.

1889-'90. 130 snags removed from the channel, and 314 trees and shore snags cleared from the banks, '90, 1886.

1890-'91. No operations, '91, 1987.

1891-'92. 40,416 snags, logs, and stumps cleared from the channel; 11,156 shore snags removed; 66,557 leaning trees removed or girdled; 20,060 square yards brush and willows cut; wreck removed, '92, 1616.

**Projects.**

By Maj. Benyaurd, 1880, for improvement from Wallace to the mouth, 280 miles, by removal of obstructions; estimated cost, \$20,020, '81, 1424, 1428.

By Capt. Bergland, 1884, for closing 3 outlets of Boeuf River near Point Jefferson; estimated cost, \$8,500, '85, 235, 1503, 1546.

In 1892 \$26,000 was estimated as required to complete the closure of the three outlets, for continuing the removal of obstructions, and for survey of Boeuf River, '92, 1616.

**BAYOU BUFFALO, TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 89.)

**Appropriations.**

1881-'87 .....	\$118,750
1888 .....	25,000, '88, 1288.
1890 .....	25,000, '90, 1809.
1892 .....	25,000, '92, 1551.

Total ..... 193,750

List of appropriations, '91, 1927.

**Commerce.**

Cotton shipments, '90, 1808.

**Contracts.**

1888. J. J. Atkinson, for dredging and rock removal, at a total of \$24,192, '89, 1561.

1891. J. J. Atkinson, for dredging and removal of trees and logs, at a total of \$21,110, '91, 1927.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 174; '89, 205; '90, 185; '91, 234; '92, 227.

ENGINEERS IN CHARGE:

Maj. O. H. Ernst, 1886-'90. Reports, '88, 1286; '89, 1559.

Maj. C. J. Allen, 1890-'—. Reports, '90, 1807; '91, 1924; '92, 1548.

ASSISTANT.

R. B. Telfor. Reports, '88, 1288; '89, 1561; '91, 1928; '92, 1551.

**BAYOU BUFFALO, TEX.—Continued.****Operations.**

- 1887-'88. 56,677 cubic yards material and 2,852 cubic feet logs removed from the bayou, '88, 1287.  
 1888-'89. 48,104 cubic yards material and 1,795 cubic feet sunken logs removed, '89, 1560.  
 1889-'90. 6,651 cubic yards material dredged and 1,062 cubic feet logs and stumps removed, '90, 1808.  
 1890-'91. 26,000 cubic yards material dredged; 2,900 cubic yards material dug from the banks; 2,900 logs removed from the channel and 13,348 trees from the banks, '91, 1925.  
 1891-'92. Removal of stumps and logs and excavation of material from projecting points, '92, 1551.

**Physical Characteristics.**

Description of the bayou, '90, 1807.

**Projects.**

- By Maj. Mansfield, 1880, for the formation of a channel 100 feet wide and 12 feet deep between Simms Bayou and mouth of White Oak Bayou at Houston; revetment of bank, removal of trees, and dredging; estimated cost, \$385,299, '81, 1343, 1344, 1346; '91, 1925; '92, 1550.  
 The locality not considered capable of permanent improvement, '87, 190.

**BAYOU CARLIN, LA.—EXAMINATION OF.****Engineers.**

- CHIEF OF ENGINEERS.  
 Report, '91, 229.  
 ENGINEER IN CHARGE.  
 Maj. J. P. Quinn. Report, '91, 1838.

**Physical Characteristics.**

Description of the locality, '91, 1838.

**Plans.**

- In 1891 Col. Comstock did not consider the bayou worthy of improvement, '91, 1839.

**Surveys.**

- Examination ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Quinn, '91, 1838.

**BAYOU CASTOR, LA.—EXAMINATION OF.****Engineers.**

- CHIEF OF ENGINEERS.  
 Report, '91, 249.  
 ENGINEER IN CHARGE.  
 Capt. J. H. Willard. Report, '91, 2028.  
 ASSISTANT.  
 R. S. Buck. Report, '91, 2029.

**Physical Characteristics.**

Description of the locality, '91, 2029.

**Plans.**

- In 1891 Capt. Willard did not consider the bayou worthy of improvement in view of the small commercial interests to be benefited, '91, 2028.

**Surveys.**

- Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Willard, '91, 2028.

**BAYOU CEDAR, TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 111.)

**Appropriations.**

1890.....	\$18, 150, '91, 1923.
1892.....	14, 000, '92, 1545.
Total .....	32, 150

**BAYOU CEDAR, TEX.—Continued.****Contracts.**

1891. A. M. Shannon & Co., for dredging, at 24 cents per cubic yard; brush mattress in place, at \$6 per cord, and stone in place, at \$2.50 per cubic yard, '92, 1545.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 207; '90, 186; '91, 233; '92, 227.

**ENGINEERS IN CHARGE.**

Maj. O. H. Ernst, 1888. Report, '90, 1815.

Maj. C. J. Allen, 1888.— Reports, '90, 1816; '91, 1922; '92, 1543.

**ASSISTANT.**

R. B. Talfor. Reports, '90, 1817; '92, 1546.

**Operations.**

1891-'92. 10,350 cubic yards of material dredged; 833 cords of brush mattress and 2,278 cubic yards stone in place, '92, 1545.

**Plans.**

By Maj. Allen, 1889, for excavation of a channel through the bar at the mouth of the bayou, by dredging and revetment; for a 5-foot channel, \$18,150 to \$20,735; for a 6-foot channel, \$24,035 to \$51,700, '90, 1817, 1818.

**Projects.**

By Maj. Allen, 1889, for improvement of the bayou by dredging a channel 100 feet wide and 5 feet deep at mean low water; also protection of the channel thus formed by brush and stone walls or revetment, with occasional dredging to maintain the channel depth; estimated cost, \$32,500, '91, 1923; '92, 1544.

**Surveys.**

Survey for removal of bar at mouth ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Allen, '90, 1816.

**BAYOU CHEVREUIL AND BAYOU TIGRE, LA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 229.

**ENGINEER IN CHARGE.**

Capt. W. L. Fisk. Report, '91, 1841.

**Physical Characteristics.**

Description of the locality, '91, 1841.

**Plans.**

In 1891 Capt. Fisk did not consider either Bayou Chevreuil or Bayou Tigre worthy of improvement by the General Government, '91, 1841.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Fisk, '91, 1841.

**BAYOU CHITTA (BOGUE CHITTO), LA.—IMPROVEMENT OF.****Appropriations.**

1890..... \$5,000, '91, 1800.

1892..... 5,000, '92, 1466.

Total ..... 10,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 193; '91, 220; '92, 214.

**ENGINEER IN CHARGE.**

Maj. A. M. Damrell, 1888.— Reports, '89, 1465; '91, 1800; '92, 1466.

**Operations.**

1891-'92. Preparation of plant, '92, 1466.

**Plans.**

By Maj. Damrell, 1889, for improvement of the bayou, securing a channel 3 feet deep, by removal of snags, logs, overhanging trees, and fish traps, and closing the west mouth from its junction up to Alford's Bridge; estimated cost, \$30,000, '89, 1466; '91, 220; '92, 1466.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Damrell, '89, 1465.



**BAYOU COCODRIE, LA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 229.

ENGINEER IN CHARGE.

Capt. W. L. Fisk. Report, '91, 1849.

**Plans.**

In 1890 Capt. Fisk did not consider the bayou worthy of improvement, '91, 1850.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Fisk, '91, 1849.

**BAYOU COURTABLEAU, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 40.)

**Appropriations.**

1880-'87 .....	\$24,000
1888 .....	5,000, '88, 1256.
1890 .....	2,200, '90, 1749.

Total ..... 31,200

List of appropriations, '90, 1747.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 170; '89, 198; '90, 179; '91, 225; '92, 219.

ENGINEERS IN CHARGE.

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1254; '89, 1491; '90, 1747.

Maj. J. B. Quinn, 1891-'— . Reports, '91, 1826; '92, 1500.

**Operations.**

1887-'88. Repairs to old dams in the Big and Little Fardoche, and new dam begun in Bayou English, '88, 1255.

1888-'89. No operations, '89, 1492.

1889-'90. Broken dams in bayous Manizelle, English, and Fardoche repaired with sheet piling, '90, 1749.

1890-'91. Repairs to plant, '91, 1827.

1891-'92. Repairs to dams at Cane, Manizelle, and Big Fardoche bayous, '92, 1501.

**Projects.**

By Maj. C. W. Howell, 1880, to improve low-water navigation between Port Barre and Atchafalaya by removal of obstructions, closing run-out bayous, and construction of a needle dam 4 miles above Port Barre; estimated cost, \$40,000, '80, 1160.

In 1883 Maj. Stickney increased the previous estimate by \$38,500, to provide for masonry lock walls instead of timber construction previously proposed, '83, 1122, 1124; '85, 1403.

In 1884 Capt. Turtle proposed that all other work be held in abeyance until the bayous on the south side of Bayou Courtableau are closed, at an estimated cost of \$16,000, '85, 1404, 1406; '86, 219.

**BAYOU D'ARBONNE, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 41.)

**Appropriations.**

1884-'87 .....	\$7,000
1888 .....	2,000, '88, 1350.
1890 .....	2,000, '90, 1880.
1892 .....	4,000, '92, 1609.

Total ..... 15,000

List of appropriations, '91, 1981.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 178; '89, 209; '90, 189; '91, 240; '92, 1609.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1886-'—. Reports, '88, 1349; '89, 1599; '90, 1879; '91, 1980; '92, 1609.

**BAYOU D'ARBONNE, LA.—Continued.****Operations.**

- 1887-'88. 3,036 leaning trees and shore snags cut; 243 logs removed from the channel, and 12,880 square yards brush and willows cut, '88, 1350.  
 1888-'89. 1,185 snags removed from channel; 3,540 trees cut and topped, and 3,746 square yards brush cleared from banks, '89, 1599.  
 1889-'90. 600 logs and snags removed from the channel; 11,600 trees cut and topped on the banks, and 425 square yards brush cut, '90, 1880.  
 1890-'91. 53 snags cleared from the channel; 565 shore snags and logs cut; 562 trees cleared from the banks, '91, 1981.  
 1891-'92. 2,138 snags and stumps cleared; 4,200 shore snags and logs removed; 12,450 square yards brush and willows cut; 7 wrecks removed, '92, 1609.

**Projects.**

- By Maj. Miller, 1883, for the removal of logs, snags, and similar obstructions from the bayou between its mouth and Stims Bluff, a distance of about 42 miles; estimated cost, \$15,000, '84, 1376; '85, 1506.

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**BAYOU DORCHEAT, LA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 217.

ENGINEER IN CHARGE.

Capt. J. H. Willard. Report, '89, 1630.

ASSISTANT.

H. M. Marshall. Report, '89, 1630.

**Physical Characteristics.**

Description of the locality, '89, 1630.

**Plans.**

In 1889 Capt. Willard did not consider the bayou worthy of improvement or the work a public necessity, '89, 1631.

**Surveys.**

Examination ordered by act of August 11, 1881. Made, 1889, under direction of Capt. Willard, '89, 1630.

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**BAYOU DOUBLE, TEX.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 235.

ENGINEER IN CHARGE.

Maj. C. J. Allen. Report, '91, 1933.

ASSISTANT.

Lieut. C. W. Langfit. Report, '91, 1935.

**Physical Characteristics.**

Description of the bayou, '91, 1935.

**Plans.**

In 1890 Maj. Allen did not consider the bayou worthy of improvement, '91, 1934.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Allen, '91, 1933.

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**BAYOU DES GLAISES, La.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 202; '91, 230.

ENGINEER IN CHARGE.

Capt. W. L. Fisk. Reports, '89, 1512; '91, 1854.

**Physical Characteristics.**

Description of the locality, '89, 1512.

**BAYOU DES GLAISES, LA.—Continued.****Plans.**

In 1889 Capt. Fisk did not consider the bayou worthy of improvement, in view of the entirely local nature of the benefits to be derived therefrom, '89, 1513.

In 1890, after examination for clearing the bayou of obstructions from the Atchafalaya River to Cottonfort, Capt. Fisk estimated the cost of such improvement at \$2,500, '91, 1855.

**Surveys.**

Examination for slack-water navigation ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Fisk, '89, 1512.

**MAPS.**

'89, 1512.

**BAYOU LA FOURCHE, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 43.)

**Appropriations.**

1852-'87 .....	\$32, 500
1888 .....	50, 000, '88, 1249.
1890 .....	50, 000, '90, 1745.
1892 .....	50, 000, '92, 1489.

Total ..... 182, 500

List of appropriations, '92, 1489.

**Commerce.**

Increase in number of vessels following improvement, '88, 1249.

Estimated reduction in freight charges if a slack-water navigation were adopted, '88, 1249.

**Contracts.**

1888. J. H. Gardner, for dredging, at 43 cents per cubic yard, '89, 1487.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 168; '89, 196, 202; '90, 177; '91, 224; '92, 217.

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1248; '89, 1485, 1531; '90, 1742.

Maj. J. B. Quinn, 1891-'—. Reports, '91, 1821; '92, 1487.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1249.

1888-'89. Dredging and removal of obstructions resumed, '89, 1487.

1889-'90. 37,944 cubic yards material; snags, and flat and steam boat wrecks removed from the channel, '90, 1743.

1890-'91. Dredging by hired labor, '91, 1822.

1891-'92. 95,984 cubic yards material, 78 stumps, and 10 wrecks removed from the channel, '92, 1488.

**Projects.**

By Maj. Howell, in 1879, to afford low-water navigation in the bayou below Donaldsonville by the removal of snags, wrecks, and rafts, '79, 901; '81, 196.

By Capt. Turtle, 1884, for continuation of the project of 1879 from the point where work was suspended in 1883.

In 1889 operations were continued under Maj. Heuer's project of 1886 for the improvement of Bayou La Fourche by the construction of a lock at Donaldsonville to connect with the Mississippi River, converting the bayou into a salt-water canal, with dredging in the bayou so as to form a channel 5 feet deep and 75 feet wide; estimated cost, \$450,000, with annual cost of maintenance of \$8,000, '86, 1267, 1274, 1275; '87, 1366; '92, 1488.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Fisk, '89, 1531.

**BAYOU LA GRANGE, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 261.)

**Appropriations.**

1886-'87 .....	\$2, 000
1888 .....	3, 000, '88, 1163.

**BAYOU LA GRANGE, FLA.—Continued.****Appropriations—Continued.**

1890..... \$3,000, '90, 1626.

Total ..... 8,000

List of appropriations, '90, 1626.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 152; '88, 176; '90, 158; '91, 200; '92, 196,

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1162.

Capt. P. M. Price, 1889-'— Reports, '89, 1375; '90, 1625; '91, 1704; '92, 1407.

**ASSISTANT.**

J. E. Turtle. Report, '91, 1705.

**Operations.**

1887-'90. No operations, '88, 1163; '89, 1375; '90, 1626.

1890-'91. 2,671 overhanging trees cleared from the banks and 270 snags and logs removed from the banks, '91, 1706.

1891-'92. No operations, '92, 1406.

**Physical Characteristics.**

Description of the bayou, '89, 1375: '90, 1626.

**Plans.**

By Capt. Price, 1889, for giving a 4½-foot navigation through La Grange Bayou and clearing snags and logs from Holmes River; estimated cost, \$15,222, '89, 1375.

**Projects.**

By Maj. Damrell, 1881, for improvement of the bayou by deepening the channel through it to the depth of 4½ feet existing through the "Narrows;" estimated cost, \$19,944, '82, 1318; '87, 1268.

In 1891, after the expenditure of \$10,000, Capt. Price recommended that no further appropriations be made until the necessities of commerce required it, '91, 1705; '92, 1408.

**Surveys.**

Examination of La Grange Bayou and Holmes River ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Price, '89, 1375.

**BAYOU MANCHAC, LA.—(See AMITE RIVER, LA.)****BAYOU PIERRE, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 46.)

**Appropriations.**

1884-'88 ..... \$13,000

**Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 171.

**ENGINEER IN CHARGE.**

Capt. W. L. Fisk. Report, '88, 1258.

**Operations.**

1887-'88. 84 snags and 65 logs and trees removed from channel, '88, 1258.

**Physical Characteristics.**

Description of the bayou, '88, 1259.

**Projects.**

By Maj. Heuer, for the improvement of the bayou to a point 16 miles above its mouth by the removal of logs, snags, and trees; estimated cost, \$20,000, '85, 1444. Project completed in 1886, '87, 1382.

**BAYOU PLAQUEMINE, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 47.)

**Appropriations.**

1888.....	\$100,000, '89, 1490.
1890.....	100,000, '90, 1747.
1892.....	150,000, '92, 1493.

Total .....	350,000
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 169; '89, 198, 203; '90, 178, 182; '91, 225, 231; '92, 218, 223.

**BOARD OF ENGINEERS.**

Convened at New Orleans, July 17, 1891, by Special Order No. 41, to examine and report upon Maj. Quinn's project for lock at the mouth of the bayou. Report, '92, 1496, 1498. (Col. Craigbill and Majs. Mackenzie and Quinn.)

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '89, 1490; '90, 1746.

Capt. D. C. Kingman, 1889-'91. Reports, '89, 1533; '90, 1761.

Maj. J. B. Quinn, 1891-'—. Reports, '91, 1824; '92, 1491, 1493.

Lient. J. Millis, 1891-'—. Reports, '91, 1867; '92, 1517.

**ASSISTANT.**

W. G. Price. Report, '90, 1765.

**Operations.**

1888-'89. 9,284 cubic yards material dredged, '89, 1490.

1889-'90. 115,127 cubic yards mud and 689 snags and logs removed; construction of submerged spur dikes begun, '90, 1747, 1764.

1890-'91. Dredging continued in the bayou, '91, 1825.

1891-'92. 19,716 cubic yards material dredged and 170 logs and stumps cleared from the channel, '92, 1492.

**Projects.**

By Maj. Stickney, 1885, for connection of Bayou Plaquemine with the Mississippi River, via the Atchafalaya and Red rivers, by removal of snags, dredging, and construction of a lock at the mouth of the bayou; estimated cost, \$1,708,250, '85, 2973, 2984; '87, 1406, 1412.

By Capt. Kingman, 1889, to prevent further caving at the mouth of the bayou, by the construction of four timber and stone spur dikes; estimate included in the cost of Maj. Stickney's project, '90, 1762.

Details of construction of lock at the mouth of the bayou as proposed by Maj. Quinn and altered by the Board of Engineers, '92, 1494, 1498.

**Surveys.****MAPS.**

'90, 1766.

'92, Atlas, 78.

**BAYOUS ROUNDWAY AND VIDAL, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 48.)

**Appropriations.**

1888.....	\$1,000, '89, 1607.
1890.....	1,000

Total.....	2,000
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 180; '89, 212; '91, 242; '92, 234.

**ENGINEER IN CHARGE.**

Capt. J. H. Willard, 1887-'—. Reports, '89, 1606; '91, 1992; '92, 1620.

**Operations.**

1887-'88. No operations, '88, 180.

1888-'89. 162 snags removed from the channel; 714 trees and 149 square yards brush cut from the banks, '89, 1607.

1890-'91. No operations, '91, 1992.

1891-'92. 146 snags and logs cleared from the channels; 956 leaning trees cut from the banks, and 240 square yards of willow brush removed, '92, 1621.

**BAYOUS ROUNDWAY AND VIDAL, LA.—Continued.****Projects.**

By Capt. Willard, 1887, for the removal of snags and leaning trees from the canal and that part of Bayou Vidal which would remain open from Lake Palmyra to the line of levee to be built by State authority north of the lake; estimated cost, \$1,000. Increased in 1889, for further removal of obstructions, to \$3,000, '89, 1606, 1607.

**BAYOU ST. JOHN, LA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 202.

ENGINEER IN CHARGE.

Capt. W. L. Fisk. Report, '89, 1500.

**Plans.**

In 1888 Capt. Fisk did not consider the bayou worthy of improvement, '89, 1501

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Fisk, '89, 1500.

**BAYOU TECHE, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 49.)

**Appropriations.**

1870-'84 .....	\$51,200
1890.....	5,000

Total..... 56,200

List of appropriations, '92, 1503.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 202; '91, 226, 230; '92, 220.

ENGINEERS IN CHARGE.

Capt. W. L. Fisk, 1888-'92. Reports, '88, 1253; '89, 1515, 1532; '91, 1852.

Maj. J. B. Quinn, 1891-'— . Reports, '91, 1828; '92, 1503.

ASSISTANTS.

Lieut. O. T. Crosby. Report, '89, 1518.

P. H. Thomson. Report, '91, 1853.

**Operations.**

Past operations and results, '88, 1253.

1887-'91. No operations, '88, 1253; '89, 1532; '91, 1828.

1891-'92. 350 snags and stumps, 144 piles, and 66 fallen trees cleared from the channel, '92, 1503.

**Physical Characteristics.**

Description of the bayou, '89, 1516; '91, 1853.

**Plans.**

In 1889 Capt. Fisk did not consider the bayou worthy of slack-water improvement, '89, 1515.

In 1891 Col. Comstock did not consider the bayou from St. Martinsville to Port Barre worthy of improvement, '91, 1852.

**Projects.**

The project under which operations were carried on up to 1887 was proposed by Maj. Howell in 1880, and included the improvement of the bayou from New Iberia to Leonville, by the removal of obstructions and the construction of three movable dams; estimated cost, \$56,690, '80, 1159, 1166, 1169; '82, 1378.

Maj. Heuer recommends that no appropriation for lock and dam be made until the capacity of the present improvement has been tested, '85, 1399; '86, 125; '87, 1371.

**Surveys.**

Examinations, with view of putting in locks and dams, ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Fisk, '89, 1515, 1518, 1532.

MAPS.

'89, 1522.

# **BAYOU TECHE—CANAL CONNECTING WITH GRAND LAKE AT CHARENTON, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 48.)

## **Appropriations.**

1881.....\$25,000, '81, 1288.

## **Engineers.**

ENGINEER IN CHARGE.

Capt. W. L. Fisk, 1888-'— Report, '88, 1253.

## **Operations.**

History of the work, '86, 1245, 1248.

1887-'88. No operations, '88, 1253.

## **Plans.**

By Maj. Stickney, 1882, for an open canal 100 feet wide at bottom and without lock.

Estimated cost by contract, \$130,350; by hired labor, \$85,000.

For canal 50 feet wide at bottom, with lock. Estimated cost by contract, \$138,600; by hired labor, \$123,125, '83, 1117; '84, 1275. Not deemed advisable by Chief of Engineers to expend available funds for construction of the plant required to perform the work by hired labor, '87, 1275.

In 1888 Capt. Fisk stated that a slack-water navigation would only benefit that portion of the Teche country above the lock, '88, 1253.

## **Projects.**

By Maj. Howell, 1880, for the construction of a canal connecting Bayou Teche at Charenton with Grand Lake. Canal 6,594 feet long, 50 feet wide at bottom, and from 5 to 6 feet deep at ordinary low water, provided with a lock with double gates; estimated cost, \$75,000, '80, 1189; '86, 1260.

Modified in 1885 by a canal 100 feet wide at bottom and without locks, '84, 1275; '85, 1399.

Recommended by Maj. Heuer that no work be done until \$75,000 had been appropriated, '86, 1260; '87, 1374.

# **BAYOU TERREBONNE, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 50.)

## **Appropriations.**

1880-'87 ..... \$35,800

1888 ..... 3,000, '88, 1251.

Total ..... 38,800

List of appropriations, '88, 1250.

## **Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 169; '89, 197, 202; '90, 178; '91, 224, 229; '92, 218.

ENGINEERS IN CHARGE.

Capt. W. L. Fisk, 1888-'92. Reports, '88, 1250; '89, 1488, 1508; '90, 1745; '91, 1843.

Maj. J. B. Quinn, 1891-'— Reports, '91, 1823; '92, 1490.

ASSISTANT.

Lieut. O. T. Crosby. Report, '91, 1844.

## **Operations.**

1887-'90. No operations. Improvement completed, '88, 1250; '89, 1489; '90, 1745; '91, 1823; '92, 1490.

## **Plans.**

In 1886 Maj. Heuer did not consider the bayou between Houma and Thibodeaux worthy of improvement, '87, 1396.

After examination of the bayou above Houma, Capt. Fisk reported the locality as unworthy of improvement, '89, 1508.

In 1890 the bayou between Houma and Thibodeaux was examined by Capt. Fisk and reported by him as unworthy of improvement.

## **Projects.**

By Maj. Howell, 1879, for the formation of a low-water channel 4 feet deep from Houma to a point about 20 miles below by the removal of overhanging trees from the bank and the dredging of shoal areas; estimated cost, \$18,800, '80, 1158, 1179, 1180. Increased for dredging, \$5,000, '82, 1383; '87, 1367. Work not considered permanent, '80, 1158; '82, 1383; '87, 1368.

In 1887 the project for the improvement of the bayou was completed at a cost of \$35,000—\$3,000 within the estimate, '90, 1745; '92, 1490.

**BAYOU TERREBONNE, LA.—Continued.****Surveys.**

Examination of the bayou above Houma ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Fisk, '89, 1508.

Examination of the bayou from Houma to Thibodeaux ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Fisk, '91, 1843.

**BAYOU VERMILLION, BAY AND PASSES, LA.—EXAMINATION OF.****Appropriations.**

1892..... \$7,500

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 230.

ENGINEER IN CHARGE.

Capt. W. L. Fisk. Report, '91, 1855.

ASSISTANT.

P. H. Thomson. Report, '91, 1856.

**Plans.**

After examination in 1891 Capt. Fisk proposed an improvement allowing 5½ feet of water to be carried up to the crossing of the Southern Pacific Railroad, at an estimated cost of \$25,000, '91, 1856.

**Surveys.**

Examination made, 1891, under direction of Capt. Fisk, '91, 1855.

**BAYOU VIDAL, LA.—(See BAYOUS ROUNDWAY AND VIDAL, LA.)****BEAR CREEK, MISS.—SURVEY OF.**

(Continued from Vol. II, p. 51.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 213.

ENGINEER IN CHARGE.

Lieut. Col. J. W. Barlow. Report, '88, 1639.

ASSISTANT.

Lieut. H. E. Waterman. Report, '88, 1640.

**Physical Characteristics.**

Description of the locality, '88, 1639.

**Plans.**

By Lieut. Col. Barlow, 1887. (1) For improvement of the creek from Southard's Ford to its mouth, a distance of 30 miles, by construction of works of contraction and removal of snags and overhanging trees; estimated cost, \$50,000. (2) To secure a 3-foot slack-water navigation at all stages, by the construction of eight locks and dams, at an estimated cost of \$500,000, '88, 1641.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Barlow, '88, 1639.

**BEATTYVILLE, KY.—LOCK AND DAM AT.**

(See KENTUCKY RIVER.)



**BEAUFORT HARBOR, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 52.)

**Appropriations.**

1836-'87 .....	\$100, 000
1888.....	35, 000, '88, 878.
1890.....	15, 000, '90, 1134.
1892.....	10, 000, '92, 1139.

Total .....	160, 000
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**Contracts.**

1889. Chester T. Caler, for dredging, at 37½ cents per cubic yard, '89, 1070.  
 Francis H. Smith, for furnishing stone, at \$2.19 per ton, '89, 1070.  
 1890. Alabama Dredging and Jetty Company, for dredging, at 33½ cents per cubic yard, '91, 1370.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 121; '89, 140; '90, 126; '91, 161; '92, 161.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'91. Reports, '88, 875; '89, 1066; '90, 1131; '91, 1367.  
 Maj. W. S. Stanton, 1892-'— . Report, '92, 1137.

**ASSISTANTS.**

R. Ransom. Report, '88, 878.  
 E. D. Thompson. Reports, '88, 879; '89, 1070; '90, 1134.  
 W. H. Chadbourne. Reports, '91, 1370; '92, 1139.

**Operations.**

History of the work, '91, 1367.

1887-'88. 271 tons stone placed along 40 feet of surface of main jetty; 8 blocks of concrete added to same; 10 tons stone placed on middle jetty; 595 tons stone added to east jetty; repairs to landing wharf, field quarters, tramroad trestles, and derricks; 31 tons stone and 7 cords brush built into 138 linear feet of shore revetment; 44 tons stone and 22 cords brush built into 488 linear feet of shore revetment, '88, 877.

1888-'89. 1,443 tons stone placed in jetties; 10,480 cubic yards material dredged, '89, 1071.

1889-'90. 12,280 cubic yards material dredged; 5,190 tons rubble stone placed in jetties, '90, 1134, 1135.

1890-'91. 280 linear feet of brush and stone revetment built at Shackleford Point, '91, 1369.

1891-'92. 9,989 cubic yards sand dredged from bar; repairs to sand fences at Fort Macon and Shackleford Point, '92, 1140.

**Physical Characteristics.**

Original condition of the harbor, '88, 875.

**Projects.**

By Capt. Phillips, 1880, for the construction of three jetties of random stone to prevent further abrasion of Shackleford Point, and the dredging of two channels and a turning basin near Beaufort; estimated cost, \$82,103.38, '81, 1013, 1017.

In 1881 Capt. Mercur recommended a system of jetties for protection of Shackleford Point of random stone, about 300 feet long, and spaced about 300 feet apart, '82, 1095. Plan approved by Board of Engineers, with recommendation that the jetties should be founded upon mattresses, '82, 1098. Concurred in by the Chief of Engineers and approved by the Secretary of War, '82, 1096.

In 1884 Capt. Bixby recommended the expansion of the project to cover the protection of Fort Macon Point from erosion, by shore protection and jetties, '85, 168, 1081. After an expenditure of \$75,000 on previous projects, it was estimated in 1886 that \$84,000 would be required for the complete protection of Shackleford and Fort Macon points, and the formation of a dredged channel 100 feet wide and 5 feet deep at mean low water from Bulkhead Channel to Beaufort, '86, 989; '87, 1030; '91, 1368.

**Surveys.****MAPS.**

'89, 1072; '90, 1136.  
 '92, Atlas, 27, 28, 29, 30.

**BEAUFORT HARBOR AND NEW RIVER, N. C.—WATERWAY BETWEEN.**

(See also NEW RIVER, N. C.)

(Continued from Vol. II, p. 53.)

**Appropriations.**

1886-'87 .....	\$55,000
1888 .....	5,000, '88, 883.
1890 .....	15,000, '90, 1139.
1892 .....	10,000, '92, 1143.

Total .....	85,000
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**Contracts.**

1889. Alabama Dredging and Jetty Company, for dredging, at 40 cents per cubic yard, '89, 1075.

1890. Alabama Dredging and Jetty Company, for dredging, at 25 cents per cubic yard, '91, 1374.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 122; '89, 141; '90, 127; '91, 162; '92, 162.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 882; '89, 1073; '90, 1138; '91, 1373.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1141.

**ASSISTANTS.**

E. D. Thompson. Reports, '88, 884; '89, 1075; '90, 1140.

W. H. Chadbourne. Reports, '91, 1375; '92, 1144.

**Operations.**

1887-'88. 17,622 cubic yards material dredged, '88, 883.

1888-'89. 35,896 cubic yards material dredged, '89, 1074.

1889-'90. No operations, '90, 1139.

1891-'92. 14,719 cubic yards material dredged, '92, 1144.

**Physical Characteristics.**

Original condition of the waterway, '88, 882.

**Projects.**

By Capt. Bixby, 1885, for the formation of an improved channel by dredging, 3 feet deep at low water, and extending from Beaufort to Swansboro on the White Oak River; estimated cost, \$50,000, '85, 1138; '87, 1037.

Aggregate cost of completed project estimated in 1892 at \$71,040, '92, 1142.

**Surveys.****MAPS.**

'89, 1074.

**BEAUFORT RIVER, S. C.—IMPROVEMENT OF.****Appropriations.**

1890 .....	\$12,500, '91, 1486.
1892 .....	12,500, '92, 1239.

Total .....	25,000
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**Contracts.**

1890. T. Young, for dredging, at 25 cents, and rock excavation, at \$3.25 per cubic yard, '91, 1486.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 158; '90, 141; '91, 178; '92, 175.

**ENGINEER IN CHARGE.**

Capt. F. V. Abbot, 1888-'—. Reports, '90, 1234; '91, 1485; '92, 1238

**ASSISTANT.**

J. P. Allen. Reports, '91, 1486; '92, 1239.

**Operations.**

1890-'91. 3,754 cubic yards material dredged, '91, 1486.

1891-'92. 28,512 cubic yards material dredged, '92, 1238.

**Physical Characteristics.**

Description of the locality, '92, 1234.

**Plans.**

By Capt. Abbot, 1889, to secure a 15-foot channel 300 feet wide from Beaufort to the ocean, by excavation at Beaufort Shoal, and at shoal near Sea Island Chemical Works, at an estimated cost of \$116,000.

**BEAUFORT RIVER, S. C.—Continued.****Projects.**

By Capt. Abbot, for improvement of the river at the brickyard near Coosaw mouth, by excavation of a 7-foot low-water channel 200 feet wide; estimated cost, \$25,000, '90, 1236, 1237.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Abbot, '90, 1235.

**BELLE PLAINE, MINN.—(See MINNESOTA RIVER, MINN.)****BELFAST HARBOR, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 55.)

**Appropriations.**

1826-'80 .....	\$31, 266
1890 .....	10, 000, '90, 435.
1892 .....	10, 000, '92, 508.

Total..... 51, 266

List of appropriations, '88, 381.

**Commerce.**

Coal and freight traffic, '88, 381.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 14; '89, 23, 31; '90, 18, 26; '91, 23; '92, 28.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'91. Reports, '88, 381; '89, 522; '90, 435, 455; '91, 586.

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 507.

**ASSISTANT.**

A. C. Both. Report, '90, 456.

**Projects.**

The original project was by Col. Thom, 1877, for deepening, by dredging to a depth of 10 and 12 feet, the area between the wharves and deep water in the river, '76, i, 190. Completed in 1880 at a cost of \$22,000, '80, 65, 531.

Lieut. Col. Smith, 1888, proposed to increase the depth on the northeast side of the present harbor to 8 feet, by the removal of 52,000 cubic yards of material at an estimated cost of \$12,850, '88, 382. After an examination and survey in 1889 Lieut. Col. Smith submitted a project for dredging a part of the main channel to give a depth of 15 feet and a least width of 220 feet and deepening portions of the east and west sides to 8 and 13 feet, respectively, at mean low water; estimated cost, \$52,000, '90, 18, 435, 456; '91, 586; '92, 508.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Smith, '90, 435, 455.

**BELLAMY RIVER, N. H.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 54.)

**Appropriations.**

1888 .....	\$10, 000, '88, 20.
1890 .....	10, 000, '90, 453.
1892 .....	7, 500, '92, 529.

Total ..... 27, 500

**Contracts.**

1888. T. Symonds, for dredging, at 19½ cents per cubic yard, '89, 542.

1890. A. B. Martin, for dredging, at 25 cents per cubic yard, '91, 607.

**BELLAMY RIVER, N. H.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 20; '89, 29; '90, 25; '91, 30; '92, 36.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'92. Reports, '89, 540; '90, 452; '91, 605.

Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 528.

**Operations.**

1887-'88. No operations, '88, 20.

1888-'89. 22,700 cubic yards material dredged, '89, 541.

1889-'90. 21,650 cubic yards material dredged, '90, 452.

1890-'91. Dredging under contract continued, '91, 606.

1891-'92. No operations, '92, 528.

**Projects.**

By Lieut. Col. Smith, 1887, for improvement of the river for a distance of 2½ miles by dredging a channel 50 feet wide and 5 feet deep at mean low water from mouth to head of navigation; estimated cost, \$28,000, '87, 486; '89, 541. Increased in 1891 to \$35,000, '91, 606; '92, 528.

**BELLE RIVER, MICH.—ICE HARBOR OF REFUGE AT.**

(Continued from Vol. II, p. 55.)

**Appropriations.**

1881-'87 ..... \$14,000

**Engineers.****ENGINEER IN CHARGE.**

Lieut. Col. O. M. Poe. Report, '88, 1972.

**Operations.**

1887-'88. No operations. Project completed in 1885, '88, 1972.

**Projects.**

By Maj. F. Harwood, 1880, for the formation of a channel 50 feet wide and 13 feet deep from the mouth of the river to Marine City Drawbridge, and from thence to second bridge, 12 feet deep; estimated cost, \$14,465, '80, 2060; '83, 1875. Project completed in 1885 at a cost of \$14,000, '85, 2158; '87, 2262.

**BENNETTS CREEK, VA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 120.

**ENGINEER IN CHARGE.**

Lieut. G. J. Fiebeger. Report, '89, 971.

**ASSISTANT.**

T. I. George. Report, '89, 972.

**Physical Characteristics.**

Description of the locality, '89, 972.

**Plans.**

In 1888 Lieut. Fiebeger did not consider that the present or prospective demands of commerce warranted an improvement of the creek, '89, 972.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Fiebeger, '89, 971.

**BENTON HARBOR, MICH.—(See SAINT JOSEPHS RIVER, MICH.)****BERRY LAKE, IND.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 293.

**ENGINEER IN CHARGE.**

Capt. W. L. Marshall. Report, '89, 2157.

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**BERRY LAKE, IND.—Continued.****Physical Characteristics.**

Description of the locality, '89, 2157.

**Plans.**

In 1889 Capt. Marshall did not consider the locality worthy of improvement as a harbor of refuge, '89, 2157.

**Surveys.**

Examination for harbor of refuge ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Marshall, '89, 2157.

**BERWICKS BAY, LA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 229, 1847.

ENGINEER IN CHARGE.

Capt. W. L. Fisk. Report, '91, 1848.

**Plans.**

In 1891 Capt. Fisk did not consider the locality worthy of improvement, '91, 1848.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Fisk, '91, 1848.

**BEVERLY HARBOR, MASS.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 44; '90, 38.

ENGINEER IN CHARGE.

Lieut. Col. S. M. Mansfield. Report, '90, 524.

ASSISTANT.

T. T. Hunter Harwood. Report, '90, 526.

**Physical Characteristics.**

Description of the locality, '90, 524.

**Plans.**

By Lieut. Col. Mansfield, 1889, for improvement of the harbor entrance by removal of obstructing rock opposite Tucks Point, '90, 525.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Mansfield, '90, 525.

**BLACK RIVER, S. C.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 170.

ENGINEER IN CHARGE.

Capt. W. H. Bixby. Report, '91, 1435.

ASSISTANT.

Lieut. M. M. Patrick. Report, '91, 1437.

**Physical Characteristics.**

Description of the locality, '91, 1436.

**Plans.**

By Capt. Bixby, 1890, for improvement of the river by removal of snags, fallen and overhanging trees, and similar obstructions, from the mouth upward 118 miles to the railroad bridge at Kingstree; estimated cost, \$25,000, '91, 1436.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Bixby, '91, 1435.

**BIG BARREN RIVER, KY.—EXAMINATION FOR EXTENSION OF SLACK-WATER IMPROVEMENT.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 310, 2474.

ENGINEER IN CHARGE.

Maj. D. W. Lockwood, 1890. Report, '91, 2475.

ASSISTANT.

Lieut. W. L. Sibert. Report, '91, 2476.

**Physical Characteristics.**

Description of the locality, '91, 2477.

**Plans.**

In 1890 Maj. Lockwood did not consider the commerce of the locality such as to justify a slack-water improvement, '91, 2475.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Lockwood, '91, 2475.

**BIG BLACK RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 57.)

**Appropriations.**

1884-'87 .....	\$10,000
1892 .....	5,000, '92, 1622.

Total..... 15,000

List of appropriations, '92, 1622.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 181; '89, 212; '90, 191; '91, 242; '92, 234.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1886-'—. Reports, '88, 1356; '89, 1608; '90, 1890; '91, 1993; '92, 1622.

**Legislation.**

Act of legislature of Mississippi to remove bridges obstructing navigation, '88, 1357.

**Operations.**

1890-'91. The appropriation of \$5,000 in 1884 was expended in 1884-'85 in the removal of obstructions for a distance of about 75 miles above the mouth. The act of 1886 appropriating \$5,000 for continuation of the improvement provided that no part thereof should be expended until certain bridges should be so constructed as not to obstruct navigation. This was done in 1889 and work was resumed in 1890-'91; 101 snags and logs, jams, and 2 drifts cleared from the channel; 1 brush wing dam built, and 13,403 leaning trees cleared from the banks, '91, 1994.

1891-'92. No operations, '92, 1623.

**Projects.**

By Maj. Benyaard, 1881, for the removal of logs, snags, and similar obstructions from the river between the mouth and Coxs Ferry, a distance of 130 miles; estimated cost, \$32,000, '82, 1566, 1570; '87, 236. After partial completion of the project under the appropriation of 1884, the appropriation of 1886 was made conditional upon the removal of certain bridges over the river. In 1888, in view of the fact that the maintenance of the bridges was regarded as of greater practical benefit and importance than the improvement of the river, Capt. Willard recommended that no further appropriations be made, '88, 1356.

**BIG HATCHIE RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 57.)

**Appropriations.**

1880-'87 .....	\$22,000
1888 .....	5,000, '88, 1368.
1890 .....	5,000, '90, 1906.
1892 .....	3,500, '92, 1659.

Total ..... 35,500

List of appropriations, '90, 1904; '91, 2010.

**BIG HATCHIE RIVER, TENN.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 183; '89, 215; '90, 193; '91, 246; '92, 238.

**ENGINEER IN CHARGE.**

Capt. J. H. Willard, 1886-'—. Reports, '88, 1367; '89, 1618; '90, 1904; '91, 2010; '92, 1657.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1368.

1888-'89. 1,410 logs and snags removed from the channel, and 4,300 trees and shore snags and 4,684 square yards brush cleared from the banks, '89, 1619.

1889-'90. 870 snags and 143 side jams removed from the channel, and 2,860 trees and shore snags and 375 square yards brush cleared from the banks, '90, 1905.

1890-'91. No operations, '91, 2011.

1891-'92. 650 snags and logs removed from the channel; 14 side jams removed; 6,700 trees cut and 6,518 trees girdled on the banks, '92, 1659.

**Projects.**

By Maj. Benyaurd, 1879, for the removal of snags, leaning trees, and logs, from Bolivar to the mouth, a distance of 240 miles; estimated cost, \$30,000, '80, 1331, 1342; '87, 1479. Improvement not permanent, '90, 1904.

**BIG HOCKING RIVER, OHIO.—EXAMINATION OF.**

(Continued from Vol. II, p. 58.)

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 218; '92, 277.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. E. Merrill. Report, '88, 1719, 1720.

Maj. A. Stickney. Report, '92, 1964.

**ASSISTANTS.**

Lieut. L. H. Beach. Report, '88, 1720, 1721.

E. Moeser. Report, '92, 1964.

**Operations.**

1891-'92. 627 cubic yards stone and 48 logs removed from the channel, '92, 1964.

**Physical Characteristics.**

Description of the locality, '88, 1720.

**Plans.**

By Lieut. Col. Merrill, 1887, for improvement of the river from its mouth to Coolville, a distance of 5 miles, securing a navigation for light-draft boats during the medium and higher stages, by removal of overhanging trees, snags, and similar obstructions; estimated cost, \$5,000, '88, 1720.

**Surveys.**

From its mouth to Coolville. Examination ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Merrill, '87, 1835; '88, 1720.

**BIG SANDY RIVER, W. VA. AND KY.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 58.)

**Appropriations.**

1878-'87 .....	\$234, 000
1888 .....	31, 500, '88, 1788.
1890 { Big Sandy River .....	31, 000, '90, 2275.
{ Levisa Fork .....	2, 500, '90, 2466.
{ Tug Fork .....	2, 500, '91, 2468.
{ Big Sandy River .....	50, 000, '92, 2100.
1892 { Levisa Fork .....	2, 500, '92, 2109.
{ Tug Fork .....	2, 500, '92, 2111.

Total .....

356, 500

List of appropriations: Big Sandy, '92, 2100; Levisa Fork, '92, 2109; Tug Fork, '92, 2111.

**BIG SANDY RIVER, W. VA. AND KY.—Continued.****Contracts.**

1891. Marting, Mittendorf & Duis, for oak timber, at a total of \$10,977, '91, 2464.  
G. Kinsey & Co., for ironwork, at a total of \$963.44, '91, 2464.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 227, 229; '89, 265, 267; '90, 239; '91, 307, 308, 310; '92, 293, 294, 2101.

**BOARD OF ENGINEERS.**

Convened at Louisa, Ky., November 10, 1891, by S. O. No. 31, to report upon the subject of a dam to be built in the Big Sandy River near Louisa, Ky. Report, '92, 2102.

(Col. Craighill, Maj. Lockwood, and Capt. Turtle.)

**ENGINEER IN CHARGE.**

Maj. D. W. Lockwood, 1888-'— Reports, '88, 1786, 1795, 1796; '89, 1983; '90, 2274; '91, 2463, 2466, 2467, 2476; '92, 2098, 2108, 2109.

**ASSISTANTS.**

B. F. Thomas. Reports, '88, 1789; '89, 1985; '90, 2276; '91, 2465, 2467, 2468, 2478; '92, 2100.

M. W. Venable. Report, '88, 1797.

**Operations.**

1887-'88. Abutment for dam at Louisa completed and upstream lock entrance blasted out; 1,050 linear feet of protection wall built at Big White House Shoal on Levisa Fork; 455 trees and snags and 57 cubic yards rock cleared from the channel below Levisa; 880 snags and 1,744 cubic yards rock removed from Levisa Fork; 150 snags and 2,533 cubic yards rock cleared from Tug Fork, '88, 1789, 1790.

1888-'89. 2,000 cubic yards rock excavated from lock site at Louisa; 372 snags, 88 trees, 142 cubic yards solid and 376 cubic yards loose rock removed from the river below Louisa, '89, 1985.

1889-'90. Lock at Louisa completed, '90, 2275.

1890-'91. Abutment graded and portion of dam next the abutment completed, '91, 2463; 550 trees, snags, and stumps, 230 cubic yards solid and 1,523 cubic yards loose rock removed from Levisa Fork, '91, 2466; 70 cubic yards rock and 463 snags cleared from the channel, and 625 trees and stumps topped and removed from the banks of Tug Fork, '91, 2469.

1891-'92. Work on dam in Big Sandy River suspended, pending a decision in regard to the style of dam; 375 snags, logs, and trees cleared from the channels and 120 cubic yards rock blasted from points in the river, '92, 2,100; 320 cubic yards solid and 1,310 cubic yards loose rock and 816 snags, logs, and trees removed from Levisa Fork, '92, 2109; 80 cubic yards solid and 2,147 cubic yards loose rock and 1,134 snags and stumps removed from Tug Fork, '92, 2111.

**Physical Characteristics.**

Description of the river, '88, 1787; '89, 1990.

Description of Louisa (Levisa) Fork, '88, 1796.

Description of Tug Fork, '91, 2467.

Description of Russel Fork, '91, 2478.

**Plans.**

By Maj. Lockwood, 1889, for slack-water navigation from low water in the Ohio to Pikeville, on the Louisa Fork and to the mouth of Pond, on the Tug Fork, involving the construction of 18 locks and dams, at an estimated cost of \$3,396,557, '89, 1992.

By Lieut. Col. Merrill, 1887, for improvement of the Louisa (Levisa) Fork of the Sandy River by removal of snags and boulders, at an estimated cost of \$5,750, '88, 1797.

In 1890 Maj. Lockwood did not consider the Russel Fork of the Big Sandy River worthy of improvement, '91, 2476.

**Projects.**

By Lieut. Col. Merrill, 1878, for the improvement of the natural channel of the Big Sandy River to afford a better raft and push-boat navigation; estimated cost, \$15,000, '80, 1828.

In 1880, modified by the construction of a lock and dam at Louisa, Ky., at an estimated cost of \$60,000, '80, 1828.

Increased by Capt. Cuyler, 1881, to \$110,000, '81, 1981. Increased by Capt. Post, 1883, to \$213,237.39, '83, 1566.

From 1878 to 1886, \$234,000 was appropriated. In 1887 it was estimated that \$62,645.31 would be required to complete the project, '87, 1824.

In 1891 the Board of Engineers proposed the construction of a movable dam of needles, supported by trestles, Poiré's system, on the Big Sandy River near Louisa, Ky., at an estimated cost of \$93,029.25, '92, 2102.



**BIG SANDY RIVER, W. VA. AND KY.—Continued.****Projects—Continued.**

The project for the improvement of the Levisa Fork of the Big Sandy River consists of facilitating rafting and push-boat navigation by removal of rock, snags, stumps, and similar obstructions, at an annual estimated cost of \$2,500, '91, 2466.

The project for improvement of the Tug Fork of the Big Sandy River consists in clearing the channel of rocks, snags, and stumps, and excavating channels through the ripples and shoals, to facilitate log rafting in the upper portion of the stream, and to provide a low-water push-boat channel, at an annual estimated cost of \$2,500, '91, 2468.

**Surveys.**

Examination, from Catlettsburg to Pikeville on Louisa Fork, and to the mouth of Pond Creek on Tug Fork, ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Lockwood, '89, 1990.

Survey of the Louisa (Levisa) Fork of Sandy River, ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Merrill, '88, 1798. Examination of Russel Fork, ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Lockwood, '91, 2476.

**BIG SUNFLOWER RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 60.)

**Appropriations.**

1879-'87 .....	\$47, 000
1888 .....	5, 000, '88, 1367.
1890 .....	5, 000, '90, 1903.
1892 .....	5, 000, '92, 1656.

Total ..... 62, 000

List of appropriations, '88, 1367; '91, 2007.

**Commerce.**

Reduction in freight rates consequent upon improvement, '89, 1617; '91, 245.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 183; '89, 214; '90, 193; '91, 245; '92, 238.

**ENGINEER IN CHARGE.**

Capt. J. H. Willard, 1886-'—. Reports, '88, 1365; '89, 1617; '90, 1901; '91, 2007; '92, 1654.

**Operations.**

1887-'88. 117 snags and 164 cubic yards earth removed from the channel; 5,151 linear feet wing dams built; 319 trees and 8,260 square yards willows cleared from the banks, '88, 1366.

1888-'89. 140 logs and snags removed from the channel, and 619 trees cleared from the banks, '89, 1617.

1889-'90. 813 linear feet of wing dams built; 15 snags removed from the channel and 5 trees from the banks; 375 linear feet of brush wing dams built, '90, 1902;

1890-'91. 645 snags and 2 wrecks removed from the channel, and 320 trees cleared from the banks; 375 linear feet of brush wing dams built, '91, 2008.

1891-'92. 50 snags and logs removed from the channel, and 23 trees cut from the banks, '92, 1655.

**Projects.**

By Maj. Benyaurd, 1879, for improving the river to a depth of from 3 to 3½ feet by removal of obstructions from the lower part of the river, and the improvement of Olephant Bar and Muscle Shoals by wing dams; estimated cost, \$66,000, '79, 970; '86, 234; '88, 1365.

**BILOXI HARBOR, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 61.)

**Appropriations.**

1882-'87 .....	\$17, 500
1888 .....	18, 500, '88, 1215.
1890 .....	9, 000, '90, 1711.

Total ..... 45, 000

**BILOXI HARBOR, MISS.—Continued.****Commerce.**

Benefit to commerce from improvement, '88, 1215; '89, 1448.

**Contracts.**

1887. G. C. Fobes & Co., for dredging, at 17 cents per cubic yard, '88, 1215.

1890. Alabama Dredging and Jetty Company, for dredging, at 14½ cents per cubic yard, '90, 1710.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 164; '89, 191; '90, 172; '91, 219; '92, 212.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1882—'. Reports, '88, 1214; '89, 1447; '90, 1709; '91, 1793; '92, 1458.

**Operations.**

1887-'88. 81,686 cubic yards of material dredged, '88, 1215.

1888-'90. No operations, '89, 1448; '90, 1710.

1890-'91. 97,092 cubic yards material dredged, '91, 1794.

1891-'92. No operations, '92, 1460.

**Projects.**

By Maj. Damrell, 1881, for dredging the channel between the wharves at Biloxi and deep water in Mississippi Sound to 8 feet; estimated cost, \$35,000, '82, 1322, 1323. The work not considered susceptible of permanent improvement, '84, 1217. Estimated cost increased in 1885 to \$55,000, '85, 1361; '91, 1793.

Present project completed, '92, 1460.

**BLACK CREEK SHOAL, LAKE ONTARIO.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '92, 420.

**ENGINEER IN CHARGE.**

Capt. D. C. Kingman. Report, '92, 3428.

**ASSISTANT.**

W. P. Judson. Report, '92, 3429.

**Surveys.**

Survey of Black Creek Shoal, made 1891, under direction of Capt. Kingman, '92, 3428.

**BLACK LAKE (HOLLAND) HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 61.)

**Appropriations.**

1852-'87 .....	\$259,615.31
1888.....	5,000.00, '88, 1914.
1890.....	10,000.00, '90, 2653.
1892.....	5,000.00, '92, 2350.

Total ..... 279,615.31

List of appropriations, '92, 2348.

**Contracts.**

1891. E. G. Crosby, for timber, at \$18 per M feet, and brush, at \$4 per cord. Gaylord & Wing, for hemlock lumber, at \$12 per M feet. G. W. Crouter, for bolts and nails, at 3¼ cents per pound, '91, 2698.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 256; '89, 301; '90, 271; '91, 341; '92, 327.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1913.

Maj. Wm. Ludlow, 1889-'—. Reports, '89, 2187; '90, 2652; '91, 2696; '92, 2348.

**Operations.**

1887-'88. Construction of superstructure by hired labor commenced, '88, 1914.

1888-'89. Repairs to piers and sand faces, '89, 2187.

1889-'90. 17,526 cubic yards material dredged, '90, 2652.

1890-'91. 17,500 cubic yards material dredged, '91, 2697.

1891-'92. Repairs to piers and revetments, and construction of sand fence, '92, 2348.

**BLACK LAKE (HOLLAND) HARBOR, MICH.—Continued.****Private and Corporate Work.**

Dredging carried on by the citizens of Holland, '90, 2652.

**Projects.**

The projects of 1866 and 1873 proposed the formation of a channel of entrance of navigable width and not less than 12 feet deep by pier extension and dredging; estimated cost in 1866, \$106,238.04, '66, iv, 104; '83, 1827.

From 1852 to 1884, \$238,673.23 had been expended and had resulted in obtaining a channel of entrance 9 feet deep, '84, 1988, 1989.

In 1883 Capt. Lockwood proposed placing an additional crib, 50 feet long, at the outer end of each pier, and completing the repairs to the piers at an estimated cost of \$35,000, '84, 1989.

In 1891 Maj. Ludlow proposed the completion of the improvement by pier extension, repairs, and dredging; estimated cost, \$45,000, '91, 2697.

**BLACK RIVER, ARK. AND MO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 62.)

**Appropriations.**

1880-'87 .....	\$56,000
1888.....	{ 5,000, '88, 1414.
	{ 7,000, '88, 190.
1890.....	{ 5,000, '90, 1950.
	{ 7,000, '90, 1951.
1892.....	5,000, '92, 1690.

Total ..... 85,000

**Commerce.**

Benefit to be derived from improvement, '88, 1414; '89, 1661.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 189, 190; '89, 223; '90, 200; '91, 254, 255; '92, 245.

ENGINEER IN CHARGE.

Capt. H. S. Taber, 1884-'— Reports, '88, 1413; '89, 1660, 1662; '90, 1948, 1950; '91, 2055, 2058; '92, 1689.

**Obstructions.**

Obstruction of the river by sunken rafts, '91, 3868.

**Operations.**

1887-'88. No operations, '88, 1413.

1888-'89. 293 snags and 12 drift masses removed from the channel, and 19,200 trees cleared from the banks, '89, 1663.

1889-'90. 433 snags and 27 drift piles removed from the channel, and 22,014 trees cleared from the banks, '90, 1948, 1951.

1890-'91. 406 snags, 23 drift piles, and 10,450 overhanging trees removed from the river, '91, 2059.

1891-'92. 1,755 snags and 166 drift piles cleared from the channel, and 24,622 trees cut from the banks, '92, 1690.

**Projects.**

By Maj. Benyaud, 1879, for the improvement of the river between Poplar Bluff and White River, by the removal of logs, snags, and trees, and the construction of wing dams; estimated cost, \$80,800, '80, 1329.

In 1885 Capt. Taber considered that an annual appropriation of from \$8,000 to \$10,000 would be required to keep the river available for navigation, '85, 247; '88, 1403; '92, 1690.

**BLACK RIVER HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 63.)

**Appropriations.**

1879-'87 .....	\$210,204.77
1888.....	10,000.00, '88, 2000.
1890.....	12,000.00, '90, 2772.
1892.....	20,000.00, '92, 2502.

Total ..... 252,204.77

List of appropriations, '92, 2502.

**BLACK RIVER HARBOR, OHIO—Continued.****Contracts.**

1888. B. S. Horton, for pier extension and repair, at a total of \$9,162.90, '89, 2319.  
 1889. O. Townsend, for dredging, at 35 cents per cubic yard, '90, 2776.  
 1890. J. Stang, for pier extension and repair, at a total of \$2,184.75. J. Stang, for pier extension and repair, at a total of \$7,029.80, '91, 2851.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 273; '89, 325; '90, 294; '91, 369; '92, 349.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1882-'92. Reports, '88, 1999; '89, 2317; '90, 2775; '91, 2849.  
 Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2501.

**Operations.**

- 1887-'88. Pier repair continued under contract, '88, 2000.  
 1888-'89. Extension of west pier and repairs to east and west piers continued under contract, '89, 2317.  
 1889-'90. 2,000 cubic yards material dredged, '90, 2776.  
 1890-'91. 6,400 cubic yards material dredged from the channel between the piers; east pier extension and dredging in progress, '91, 2849.  
 1891-'92. East pier extension completed; minor repairs to superstructure of old piers, '92, 2501.

**Projects.**

History of the work from 1828 to 1880, '80, 2131.

Projects between 1828 and 1880 proposed, by pier extension and dredging, the formation of a channel of entrance of navigable width and not less than 14 feet deep.  
 In 1880 an expenditure of \$175,138.92 had resulted in the formation of a channel not less than 15 feet deep, '80, 226, 2132.

In 1880 Maj. Wilson proposed the extension of the piers to the 16-foot curve in the lake, with the renewal of 2,000 linear feet of old superstructure; estimated cost, \$42,000, '80, 2131; increased in 1882 to \$45,000, '82, 2397; increased in 1884 to \$64,000, on account of unexpected repairs, '84, 2096.

**Surveys.****MAPS.**

'91, 2850.

**BLACK RIVER, MICH.—IMPROVEMENT OF MOUTH OF.**

(Continued from Vol. II, p. 64.)

**Appropriations.**

1888.....	\$10,000, '89, 2260.
1890.....	10,000, '90, 2736.
1892.....	10,000, '92, 2472.

Total ..... 30,000

**Commerce.**

Benefit of improvement to general lake commerce, '89, 2260.

**Contracts.**

1889. W. Richardson, for dredging, at 20 cents per cubic yard, '89, 2260.  
 1891. Bay City Dredging Company, for dredging, at 16 cents per cubic yard, '91, 2782.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 264; '89, 313; '90, 283; '91, 355; '92, 339.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1886-'—. Reports, '89, 2259; '90, 2735; '91, 2782; '92, 2471.

**Operations.**

- 1887-'88. No operations, '88, 264.  
 1888-'89. 20,800 cubic yards material dredged, '89, 2260.  
 1889-'90. 26,000 cubic yards material dredged, '90, 2736.  
 1890-'91. 17,504 cubic yards material dredged, '91, 2783.  
 1891-'92. 40,011 cubic yards material dredged, '92, 2471.

**Physical Characteristics.**

Description of the locality, '90, 2735.

**Projects.**

By Lieut. Col. Poe, 1887, for improvement of the river by removal of the shoal at its mouth to a uniform depth of 17 feet; estimated cost, \$69,300, '87, 2280.

**BLACK RIVER AT PORT HURON, MICH.—IMPROVEMENT OF.****Appropriations.**

1890..... \$25,000, '91, 2781.  
 1892..... 10,000, '92, 2470.

Total ..... 35,000

**Contracts.**

1891. C. E. Mitchell, for dredging, at 11½ cents per cubic yard, '91, 2781.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 320; '91, 354; '92, 339.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1888'— Reports, '89, 2291; '91, 2780; '92, 2469.

**Operations.**

1890-'91. 18,225 cubic yards material dredged, '91, 2781.

1891-'92. 73,048 cubic yards material dredged, '92, 2470.

**Physical Characteristics.**

Description of the locality, '89, 2291.

**Projects.**

By Col. Poe, 1889, for improvement of Black River by excavation of a channel 15 feet deep, and of a width varying from 160 to 87 feet from the mouth through the city of Port Huron to the Grand Trunk Railroad Bridge, a distance of 8,200 feet; estimated cost, \$55,110, '89, 2292-93. Depth increased in 1891 to 16 feet, increasing the estimated cost to \$75,000, '91, 2781; '92, 2469.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Col. Poe, '89, 2292.

**BLACK RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 64.)

**Appropriations.**

1886-'87 ..... \$3,000  
 1892..... 10,000, '92, 1157.

Total ..... 13,000

**Commerce.**

Value of improvement to river navigation, '89, 1083.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 123; '89, 143; '90, 128; '91, 164; '92, 164.

ENGINEERS IN CHARGE.

Capt. W. H. Bixby, 1884-'92. Reports, '88, 889; '89, 1081; '90, 1145; '91, 1387.

Maj. W. S. Stanton, 1892'— Report, '92, 1154.

ASSISTANT.

C. Humphreys. Report, '88, 891; '90, 1147; '91, 1388.

**Operations.**

History of the work, '91, 1387.

1887-'88. 438 logs and stumps removed from river channel, and 472 trees and 98 cords of brush removed from the banks, '88, 890.

1888-'89. No operations, '89, 1082.

1889-'90. 30 piles and snags removed from the channel, and 155 trees and 573 cords of brush removed from the banks, '90, 1146.

1890-'92. No operations, '91, 1387; '92, 1156.

**Physical Characteristics.**

Original condition of the river, '88, 889.

Water-gauge record for 1891, '91, 1388.

**Projects.**

By Capt. Bixby, 1884, to secure a thoroughly cleared natural channel over the 70 miles of river between its mouth and Lisbon, and afterwards a 4-foot low-water channel below Point Caswell; estimated cost, \$33,500, '85, 1148; '87, 1043.

**BLACK RIVER, N. Y.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 2429.

ENGINEER IN CHARGE.

Capt. C. F. Palfrey. Report, '87, 2129.

**BLACK RIVER, N. Y.—Continued.****Physical Characteristics.**

Description of the locality, '89, 2429.

**Plans.**

In 1889 Capt. Palfrey considered the expenditure necessary for improvement of the river disproportionate to the benefits to be derived therefrom, '89, 2432.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Palfrey, '89, 2429.

**BLACK AND DWAMISH RIVERS, WASH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 409.

ENGINEER IN CHARGE.

Capt. T. W. Symons. Report, '91, 3257.

ASSISTANT.

A. J. McMillan. Report, '91, 3259.

**Physical Characteristics.**

Description of the locality, '91, 3258.

**Plans.**

In 1890 Capt. Symons did not consider the locality worthy of improvement, '91, 3258.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Symons, '91, 3258.

**BLACK ROCK HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 65.)

**Appropriations.**

1884-'87.....	\$46,550
1888.....	10,000, '88, 560.
1890.....	5,000, '90, 642.
1892.....	5,000, '92, 691.

Total..... 66,550

List of appropriations, '88, 560; '91, 785.

**Contracts.**

1889. J. H. Fenner, for dredging, at 16 cents per cubic yard, '89, 705.

1891. G. B. Beardsley, for dredging, at 14.6 cents per cubic yard, '91, 785.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 51; '89, 63, 70; '90, 57; '91, 70; '92, 75.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1886-'—. Reports, '88, 558; '89, 702, 741; '90, 640; '91, 784; '92, 689.

**Operations.**

1887-'88. 24,868 cubic yards material dredged from the channel, '88, 559.

1888-'89. No operations, '89, 703.

1889-'90. 58,000 cubic yards material dredged, '90, 641.

1890-'91. No operations, '91, 785.

1891-'92. 28,000 cubic yards material dredged, '92, 690.

**Physical Characteristics.**

Description of the harbor, '88, 558; '89, 741.

**Projects.**

In 1836-'38, \$21,550 was expended in closing a breach across Fairweather Island, '85, 653.

By Lieut. Col. McFarland, 1883, for the construction of a riprap breakwater 2,700 feet long, extending from Fairweather Island to the mainland and dredging a channel 3,300 feet long, 80 feet wide, and 6 feet deep at mean low water up Cedar Creek; estimated cost, \$80,000, '84, 667, 668; '85, 653; '87, 613; '92, 690.

**BLACK ROCK HARBOR, CONN.—Continued.****Surveys.**

Examination for breakwater to Penfield Reef and south from Fairweather Island ordered by act of August 11, 1888. Made, 1888, under direction of Col. Houston, '89, 741.

**BLACK WARRIOR RIVER, ALA.—(See WARRIOR RIVER, ALA. AND GA.)****BLACKWATER RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 67.)

**Appropriations.**

1878-'82 ..... \$14,000

**Engineers.**

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1888-'— Report, '88, 772.

**Operations.**

1887-'88. No operations, '88, 772.

**Projects.**

By S. T. Abert, 1875, for dredging and the removal of snags and trees from the mouth to Franklin; estimated cost, \$14,850, '75, ii, 162; '87, 120.

**BLOCK ISLAND HARBOR OF REFUGE, R. I.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 67.)

**Appropriations.**

1870-'87 ..... \$345,000  
 1888 ..... 15,000, '88, 507.  
 1890 ..... 15,000, '90, 578.  
 1892 ..... 24,000, '92, 632.

Total ..... 399,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 41; '89, 52; '90, 47; '91, 59; '92, 63.

ENGINEERS IN CHARGE.

Maj. W. R. Livermore, 1887-'92. Reports, '88, 504; '89, 631; '90, 557; '91, 723.

Capt. W. H. Bixby, 1892-'— Report, '92, 630.

**Operations.**

1887-'88. Six-sevenths of the gap filled; timber jetty forming shore end of western wall completed and filled with stone; north wall commenced, '88, 506.

1888-'89. 3,550 tons of riprap granite placed in north wall of inner harbor, '89, 632

1889-'90. 1,941 tons of riprap granite placed in north wall of inner harbor, and 420 tons on the breakwater; 3,025 cubic yards sand dredged from shoal at entrance to harbor, '90, 576.

1890-'91. 3,711 tons of riprap granite placed in extension of north wall of enlarged inner harbor, '91, 725.

1891-'92. 2,381 tons of riprap granite placed in extension of north sea wall, '92, 631.

**Physical Characteristics.**

Description of the locality, '90, 375.

**Projects.**

By Lieut. Col. Warren, 1880, for dredging the inner harbor to a depth of 9 feet, with the removal of a wreck therefrom; estimated cost, \$8,000, '80, 391, 392; completed, 1881, '81, 563.

By Lieut. Col. Warren, 1881, for the construction of a harbor wall on the east side of the inner harbor, and the construction of a jetty to protect the harbor from material washed from the southwest and eastward; estimated cost, \$19,000, '82, 563.

**BLOCK ISLAND HARBOR OF REFUGE, R. I.—Continued.****Projects—Continued.**

The project under which work was being carried on in 1888 was a consolidation of four prior projects, namely, one by Lieut. Col. Elliot, 1883, for replacing the timber cribs on north and west sides of the inner harbor by walls of stone, and for replacing south wharf by a retaining wall backed with earth, at an estimated cost of \$30,000, '83, 497; another project by Lieut. Col. Elliot in 1884, for closing a gap 200 feet long in the main breakwater, at an estimated cost of \$30,000, '84, 628; another by Lieut. Col. Elliot, 1885, for the enlargement of the inner harbor to an area of about 18½ acres, at an estimated cost of \$46,189, '86, 611, 613; and lastly a project by Maj. Livermore, 1888, for removal of a shoal obstructing navigation at the entrance to Block Island Harbor, giving a depth of 9 feet to a line 20 feet from the breakwater; estimated cost, \$5,000, '88, 505, 506; total estimated cost of project, \$111,189. These combined projects provided for a harbor of refuge on the eastern side of the island, consisting of an inner harbor or basin for small vessels and an exterior harbor for large ones. The basin was to be about 250 by 300 feet in area and inclosed save for an opening 80 feet in width. The exterior harbor was to be formed by a riprap breakwater 1,000 feet in length, '91, 724; '92, 631.

**Surveys.****MAPS.**

'88, 506.

**BLUE HILL HARBOR, ME.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 32.

**ENGINEER IN CHARGE.**

Lieut. Col. J. A. Smith. Report, '91, 611.

**Physical Characteristics.**

Description of the locality, '91, 611.

**Plans.**

In 1890 Lieut. Col. Smith did not consider the probable benefits to commerce sufficiently general in their character to justify the great expense involved in an improvement of the locality, '91, 614.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Smith, '91, 611.

**BLUFF CREEK, MISS.—IMPROVEMENT OF.****Appropriations.**

1890..... \$1,000, '91, 1792.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 193; '91, 218; '92, 211.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1888-'—. Reports, '89, 1461; '91, 1792; '92, 1457.

**Operations.**

1891-'92. 482 stumps and snags removed from the channel, and 4,000 overhanging trees cleared from the banks, '92, 1457.

**Projects.**

By Maj. Damrell, 1889, for improvement of the creek by removal of snags, logs, and leaning trees, at an estimated cost of \$1,000, '89, 1461. Project completed in 1892, '92, 1457.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Damrell, '89, 1461.

**BOGUE SOUND, N. C.—(See BEAUFORT HARBOR AND NEW RIVER, N. C.)**



**BOQUET RIVER, N. Y.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 388.

ENGINEER IN CHARGE.

Maj. M. B. Adams. Report, '91, 2940.

**Physical Characteristics.**

Description of the locality, '91, 2940.

**Plans.**

In 1890 Maj. Adams did not consider the river worthy of improvement, '91, 2941.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Adams, '91, 2940.

**BOSTON HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 69.)

**Appropriations.**

1828-'87 .....	\$2, 184, 196. 10
1888.....	125, 000. 00, '88, 455.
1890.....	145, 000. 00, '90, 505.
1892.....	300, 000. 00, '92, 582.

Total ..... 2, 754, 196. 10

List of appropriations, '92, 582.

**Contracts.**

1888. G. W. Townsend, for rock removal, at \$22 per cubic yard, '88, 455.

1889. Pigeon Hill Granite Company, for delivery of granite ashlar, at a total of \$4,747. New England Dredging Company, for dredging, at 35 cents per cubic yard, and for removal of bowlders weighing over 6 tons each, \$10, '89, 579, 580.

1890. G. W. Townsend, for rock removal, at \$29 per cubic yard. Bay State Dredging Company, for dredging, at 20 cents per cubic yard, and for removal of bowlders, at \$8 per cubic yard, '90, 503, 506. C. W. Lanpee, for dredging in Nantasket Beach Channel, at 25 cents per cubic yard, '91, 653. New England Dredging Company, for dredging in Nix's Mate Channel, at 19½ cents per cubic yard, '91, 653. A. R. Wright, for dredging at Brewster Spit, at 14 cents per cubic yard, '91, 654. Rockport Granite Company, for delivering granite ashlar at Gallops Island, at \$3,917, '91, 654.

1891. A. R. Wright, for dredging in main ship channel, at 17 cents per cubic yard, '91, 654.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 27; '89, 38, 368; '90, 33, 331; '91, 40, 424; '92, 46.

BOARD OF ENGINEERS.

Convened at Boston, July 20, 1889, by S. O. No. 38, to report upon the establishment of harbor lines in Boston Harbor. Reports, '89, 601; '90, 532. (Col. Abbot, Lieut. Cols. Gillespie and Mansfield, and Maj. Livermore.)

Convened at Boston, January 23, 1891, by S. O. No. 38, to report upon the establishment of harbor lines in Boston Harbor. Report, '91, 688. (Col. Abbot, Lieut. Cols. Gillespie and Mansfield, and Maj. Livermore.)

ENGINEERS IN CHARGE.

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 447.

Lieut. Col. S. M. Mansfield, 1889-'—. Reports, '89, 572; '90, 497; '91, 645; '92, 575, 584.

**Operations.**

Works of improvement prior to 1889, '89, 574, 575.

1887-'88. 69,000 cubic yards material dredged from main ship channel, '88, 450.

1888-'89. Repairs made to granite sea wall at Georges Island, by hired labor. 1,500 running feet of granite ashlar and 300 square yards of a hell-stone paving delivered on Gallops Island sea wall; work begun by hired labor on extension of sea wall; 146,556 cubic yards material dredged in "Upper and Lower Middles," '89, 573, 574, 575.

1889-'90. Extension of granite wall at Gallops Island completed by hired labor; repairs made to middle and north head walls at Deer Island by hired labor; 5,942 cubic yards material dredged and 111 cubic yards ledge removed from "Upper" and "Lower Middles;" 9,025 cubic yards material dredged from Nantasket Beach Channel, '90, 499, 500, 501.

**BOSTON HARBOR, MASS.—Continued.****Operations—Continued.**

- 1890-'91. Construction of Gallops Island sea wall in progress; repairs to north and middle head walls at Deer Island, '91, 647. 19,724 cubic yards material dredged from Nantasket Beach Channel, '91, 651. 16,440 cubic yards material dredged from the west end of Brewster Spit, '91, 652.
- 1891-'92. Repairs to sea wall at Great Brewster Island; extension of sea wall at Gallops Island completed; 1,100 tons of rubble stone used as riprap protection for the beach west of sea wall at Long Island; 12,070 cubic yards material dredged from west end of Brewster Spit; 130,962 cubic yards material dredged in extension of main ship channel; 74,779 cubic yards material dredged from main ship channel at upper middle bar; 70,674 cubic yards material dredged from channel between Nix's Mate and Long Island, '92, 576-81.

**Physical Characteristics.**

Description and location of outer and inner harbors, '91, 646.

**Projects.**

The projects for the improvement of Boston Harbor have had for their object, first, its *preservation* by protecting the shores of the islands and headlands by sea walls, aprons, and jetties, thus preventing additional wash into the channels, controlling the tidal scour, and preserving the full height of anchorage shelter for vessels in the roadsteads; secondly, the *improvement* of the harbor by widening, deepening, and straightening the channels through dredging and rock removal, '90, 498.

The improvements undertaken since 1866 have been projected as the necessities of the harbor required, being in general conformity with the recommendations of the United States commissioners, whose labors terminated in 1866.

The projects in detail have been as follows: Protection of western shore line of Georges Island by stone apron, to cost \$10,000, '88, 449. Increased in 1889 to \$35,000, '89, 579. Extension of sea wall at Gallops Island, to cost \$15,000, '88, 449. Repair and extension of rubble-stone apron protection to Long Island, to cost \$3,000, '88, 449. Construction of sea walls at south and east bluffs of Governors Island, to cost \$80,000, '88, 450.

In 1867 it was proposed to dredge the main ship channel to a depth of 23 feet at mean low water, 1,000 feet wide at the "Upper" and "Lower Middles," and 635 feet wide at the "Narrows." In 1870 the proposed width at the Narrows was reduced to 625 feet, and increased to 1,100 at Anchorage Shoal in the inner harbor. In 1887 it was proposed to straighten the passage through the "Narrows" by cutting off a spur projecting from Lovell's Island. In 1888 it was estimated that to complete the improvement of the main ship channel 687,000 cubic yards would require to be dredged from the "Upper Middle" in the inner harbor, at an estimated cost of \$250,000, '88, 450, 451.

The project proposed by Maj. Raymond in 1885 for the improvement of the Fort Point Channel was for the excavation of a channel 175 feet wide and 23 feet deep at mean low water, from the entrance to near Federal Street Bridge, a distance of 4,100 feet; estimated cost, \$100,000, \$60,000 being still required for completion in 1888, '88, 452, 453.

The project for improvement of the channel between Nix's Mate and Long Island, adopted in 1883, was to dredge a channel 200 feet wide, 12 feet deep at mean low water, and about 550 feet long. In 1887 it was recommended that the axis of the cut be shifted 30° to the westward, and that it be widened to 390 feet, 15 feet deep at mean low water. The original project was estimated to cost \$9,000. The project as revised in 1887 was estimated at \$25,000, '88, 453, 454.

A survey of the main ship channel east of Long Island Head was provided for in 1888, at a cost of \$6,000.

The general project in 1889, included, in addition to the above, a project for the extension of Point Allerton sea wall, to cost \$15,000; and for the repair of Great Brewster Island sea wall, to cost \$10,000, '89, 579. Also, in 1890, a project for dredging at the west end of Brewster Spit, to cost \$15,000.

The aggregate cost of the foregoing projects is \$554,000, and the aggregate estimate for completion in 1890 was \$395,000, '90, 505.

The project for improving Boston Harbor by the excavation of a channel of 23 feet depth at mean low water having been essentially completed in 1891, Lieut. Col. Mansfield proposed deepening the main ship channel in Boston Harbor to 30 feet mean low water; estimated cost, \$1,500,000, '92, 584.

**Surveys.**

Detailed survey of lower harbor from Long Island to the sea, with bottom examinations and current observations. Made, 1888, under direction of Lieut. Col. Gillespie, '88, 451.

Detailed survey of channel between Brewster's Spit and Georges Island Shoal. Made, 1890, under direction of Lieut. Col. Mansfield, '90, 501.

**MAPS.**

'88, 454.

**BRAZOS RIVER, TEX.—IMPROVEMENT OF MOUTH OF.**

(Continued from Vol. II, p. 72.)

**Appropriations.**

1880-'87 ..... \$158, 750

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 175, 1293; '89, 205; '91, 235.

**BOARD OF ENGINEERS.**

Convened at New York, November 11, 1887, to report upon improvement of mouth of the Brazos River. Reports, '88, 1299. (Cols. Casey and Abbot, Lieut. Col. McFarland, and Maj. King.)

**ENGINEER IN CHARGE.**

Maj. O. H. Ernst, 1886-'89. Reports, '88, 1291, 1294; '89, 1563.

**Operations.**

History of the work, '88, 1295.

In 1887, after considering the results of past work, the Board of Engineers suggested that no further works of improvement be attempted at this locality, '88, 1300.

**Physical Characteristics.**

Description of Brazos River, '88, 1294.

**Projects.**

By Maj. Howell, 1872, for the improvement of channel over the bar at mouth of river by means of two converging pile jetties, each five-eighths of a mile long and 400 feet apart at their outer ends; estimated cost, \$286,484, '75, i, 938, 941; '80, 1243.

The work not considered susceptible of permanent completion, '80, 1244.

By Maj. Mansfield, 1880, for parallel jetties to consist of brush, stone, and concrete; their direction to be chosen so as to fix the channel in its natural position. Approximate length of north jetty, 3,600 feet; of south jetty, 4,350 feet; estimated cost, \$522,890.44, '81, 1349. Recommended by the Board of Engineers, '81, 1355.

Concurred in by Chief of Engineers, and approved by Secretary of War, '81, 1352.

In 1887 the \$140,833 expended had not resulted in any useful effect upon the bar; the plan for improvement to receive further consideration, '87, 191.

In 1887, upon consideration of Maj. Ernst's report on the results of the survey of that year, the Board of Engineers recommended that no further works of improvement be at present attempted at this locality, '88, 1300.

**Surveys.**

Of mouth of Brazos River. Made, 1887, under direction of Maj. Ernst, '88, 1294.

**BRAZOS SANTIAGO HARBOR, TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 73.)

**Appropriations.**

1878-'87 ..... \$228, 500

1888..... 25, 000, '88, 1320.

Total ..... 253, 500

List of appropriations, '90, 1813; '91, 1832.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 176; '89, 206; '90, 185; '91, 234; '92, 227.

**ENGINEERS IN CHARGE.**

Maj. O. H. Ernst, 1886-'91. Reports, '88, 1320; '89, 1568; '90, 1813.

Maj. C. J. Allen, 1891-'—. Reports, '91, 1930; '92, 1553.

**ASSISTANT.**

Lieut. G. A. Zinn. Report, '88, 1327.

**Operations.**

1887-'91. No operations, '88, 1320; '89, 1569; '90, 1813; '91, 1931; '92, 1553.

**Physical Characteristics.**

Dimensions of harbor, as shown by surveys, from 1867 to 1887; stability of sand bottom, '88, 1326.

**Projects.**

By Maj. Mansfield, 1881, for deepening the channel across the bar, and the maintenance of a suitable harbor inside the pass by the construction of two parallel jetties at the mouth of the river, extended to the 12-foot curve, and a dam from Point Isabel to Brazos Santiago, closing the lagoon, the south jetty to be 3630 feet long; estimated cost, \$678,084.50, '81, 1367, 1372; '82, 1478, 1481, 1489, 1490; '86, 1334.

**BRAZOS SANTIAGO HARBOR, TEX.—Continued.****Projects—Continued.**

Approved by Board of Engineers, 1881, so far as the application of available funds to construction of south jetty will permit, '82, 1490; '86, 1335; '87, 1433.

In 1888, the works theretofore constructed having practically disappeared, Maj. Ernst estimated the cost of reconstruction of both jetties at \$1,130,000, '88, 1321.

The total of expenditures under appropriations at the date of rendering the above estimate was \$188,590, making the revised estimate of the cost of improvement, from the annulment of the work, \$1,318,590, '91, 1931; '92, 1554.

**Surveys.**

Of harbor and bar. Made, 1887, under direction of Maj. Ernst, '88, 1322.

**BREAKWATER AT CLEVELAND, OHIO.—(See CLEVELAND HARBOR, OHIO.)****BREAKWATER AT NEW HAVEN, CONN.—(See NEW HAVEN HARBOR, CONN.)****BRETON BAY, LEONARDTOWN, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 265.)

**Appropriations.**

1878-'87 .....	\$29,500
1888.....	3,000, '88, 816.
1890.....	5,000, '90, 1062.

Total .....	37,500
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List of appropriations, '88, 816.

**Contracts.**

1888. Atlas Dredging Company, for dredging, at 13½ cents per cubic yard, '89, 1001.

1891. Baltimore Dredging Company, for dredging, at 12½ cents per cubic yard, '91, 1258.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 109; '89, 126; '90, 112; '91, 140; '92, 141.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1878-'91. Reports, '88, 815; '89, 1001; '90, 1062.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1258.

Maj. C. E. L. B. Davis, 1892-'—. Report, '92, 1045.

**Operations.**

1887-'88. No operations for lack of funds, '88, 816.

1888-'89. 13,141 cubic yards material dredged, '89, 1001.

1889-'90. No operations for lack of funds, '90, 1062.

1890-'91. Dredging in progress under contract, '91, 1258.

1891-'92. 28,800 cubic yards material dredged, '92, 1046.

**Projects.**

By Lieut. Col. Craighill, 1875, for formation of a dredged channel 150 feet wide and 9 feet deep from Breton Bay to Leonardtown wharf; estimated cost, \$30,000, '75, ii, 108; '80, 757. After an expenditure of \$23,000 S. T. Abert proposed in 1885 an amended project, whereby the channel was to be widened to 200 feet, the basin and channel to be not less than 10 feet deep; estimated cost, \$26,000, '85, 965. In 1890 the original project was resumed, a width of 150 feet and depth of 9 feet being deemed sufficient to furnish all the facilities required by existing navigation, '91, 1258; '92, 1045.

**Surveys.****MAPE.**

'89, 1002.

8648—5

**BRIDGEPORT HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 83.)

**Appropriations.**

1886-'87 .....	\$230,000
1888 .....	10,000, '88, 557.
1890 .....	20,000, '90, 639.
1892 .....	20,000, '92, 688.

Total ..... 280,000

List of appropriations, '88, 557; '90, 639; '91, 782.

**Commerce.**

Prospective increase in business consequent upon improvement, '89, 697, 700.

**Contracts.**

1888. Charles Du Bois and Henry N. Du Bois, for dredging, at 14 cents per cubic yard, '88, 558.

1889. A. J. Beardsley &amp; Son, for dredging, at 18 cents per cubic yard, '89, 697.

1891. Brown &amp; Fleming, for stone breakwater construction, at \$1.29 per ton, '91, 782. G. B. Beardsley, for dredging, at 14.6 cents per cubic yard, '91, 783.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 50; '89, 63; '90, 56; '91, 70; '92, 74.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886— . Reports, '88, 555; '89, 693, 698, 700; '90, 637; '91, 778; '92, 685.

**Operations.**

1887-'88. 14,000 cubic yards material dredged, increasing depth over shoal to 12 feet mean low water, '88, 556.

1888-'89. 34,051 cubic yards material dredged, '89, 695.

1889-'90. 10,946 cubic yards material dredged, '90, 638.

1890-'91. 750 tons of riprap placed in the breakwater, completing 300 linear feet of the same, '91, 781.

. 1891-'92. 9,077 tons of riprap placed in the breakwater; 30,000 cubic yards material dredged, '92, 687.

**Physical Characteristics.**

Description of the harbor, '88, 555.

**Projects.**

The projects of 1871-'75 proposed the formation of a channel of navigable width and 12 feet deep from Long Island Sound to the lower bridge, at an estimated cost of \$138,000 for dredging; also a riprap jetty 1,380 feet long from Long Beach, at a cost of \$35,000, '80, 462. This work was completed in 1880 under aggregate appropriations amounting to \$195,000, when Maj. Barlow proposed the widening to 600 feet of the channel from the inner beacon to the steamboat wharf; estimated cost, \$60,000, '81, 604; '85, 651; '86, 644; '87, 610.

By Col. Houston, 1887, for dredging to 12 feet mean low water the channel from the Naugatuck Railroad Wharf up to the lower bridge; also for increasing the width of the channel to 600 feet; estimated cost, \$17,000, '88, 557. In 1889 Col. Houston modified and extended his project as follows: First, for the completion of a channel 12 feet deep at mean low water and 300 feet wide, from Long Island Sound to the lower bridge; estimated cost, \$17,000. Second, for the completion of a channel 9 feet deep and 100 feet wide from the lower bridge to the head of the harbor; estimated cost, \$8,000. Third, for the construction of a breakwater extending from a point called The Tongue in the western side of the harbor entrance, southeast to the inner beacon; estimated cost, \$30,000. Total estimated cost of project, \$55,000, with an annual expenditure for maintenance of dredged channels of \$3,000, '89, 696; '90, 637, 638.

History of projects for improvement, '91, 779.

In 1892 Col. Houston proposed to complete the channels above the bridges, to remove the shoal places above the Naugatuck Railroad Wharf, and to widen the channel eastward to the harbor lines an additional width of about 200 feet; also to complete the breakwater from The Tongue to the inner beacon; estimated cost, \$35,000, '92, 688.

**BRIDGING THE NAVIGABLE WATERS OF THE UNITED STATES.**

(Continued from Vol. II, p. 24.)

**Engineers.****BOARD OF ENGINEERS.**

Report of Board of 1888, relative to construction of certain bridges across the Missouri, Mississippi, and Illinois rivers. Reports, '88, 2374 (Lieut. Col. Suter, and Majs. Mackenzie, Miller, and Handbury); '88, 2383 (Lieut. Col. Suter and Maj. Miller).

## BRIDGING THE NAVIGABLE WATERS OF THE UNITED STATES—Continued.

**Engineers—Continued.**

CHIEF OF ENGINEERS.

Report, '88, 307, 2371.

**Commerce.**

Dimensions of coal and grain tows on the Mississippi River, '88, 2380-81.

Testimony before the Board in regard to dimensions of tows and desirable dimensions of channel spans, '88, 2397, 2398, 2400, 2404, 2406, 2408, 2409, 2410.

**Legislation.**

Bill authorizing the construction of bridges across the Missouri, Mississippi, and Illinois rivers, and prescribing the character, location, and dimensions of the same, '88, 2384.

**Plans.**

Dimensions of spans and draw openings, as fixed by the Board of 1888, for bridges over the Mississippi, Missouri, and Illinois rivers, '88, 2372-73.

### BRIDGE across the Eastern Branch of the Potomac River.

(Continued from Vol. II, p. 81.)

**Appropriations.**

1887.....	\$110,000	
1888.....	60,000, '88, 798.	

Total .....	170,000	
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**Contracts.**

1887. Groton Bridge and Manufacturing Company, for bridge construction, at a total of \$105,000, '88, 795.

1890. W. Rothwell, for watchman's house, at \$333; guard fence, at \$1.96 per square yard; painting through spans, at \$549, and wooden sidewalk construction, at \$1.10 per linear foot, '90, 1050.

W. H. Mohler, for slope paving, at \$2 per square yard; curbing, at \$1.48 per linear foot; gutters, at 45 cents per square yard, and riprap, at 80 cents per cubic yard, '90, 1050.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 106; '89, 123; '90, 110.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1887-'—. Reports, '88, 795, 798; '89, 990; '90, 1048.

**Legislation.**

Alterations in plan of bridge authorized by act of May 14, 1888, '88, 797.

**Operations.**

1887-'88. Work begun on eastern approach. Operations suspended pending settlement of controversy with Baltimore and Potomac Railroad Company, '88, 796.

1888-'89. Operations resumed under amended plan, '89, 992, 993.

1889-'90. Bridge completed, '90, 1049.

**Projects.**

Description of bridge, '88, 796.

**Surveys.**

MAPS.

'89, 992.

### BRIDGE (AQUEDUCT) at Georgetown, D. C.—ACROSS THE POTOMAC RIVER.

(Continued from Vol. II, p. 78.)

**Appropriations.**

1886.....	\$240,000	
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**Contracts.**

1888. C. Thomas, for watchman's house and wooden sidewalk construction, at a total of \$495 for the first, and \$2.25 per linear foot for the second, '88, 795.

Breen &amp; Feely, for embankment construction, at 25½ cents per cubic yard, and slope paving, at from 45½ cents to \$1.34 per square yard, '88, 795.

**BRIDGE (AQUEDUCT) at Georgetown, D. C.—Continued.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 106; '89, 123.

ENGINEER IN CHARGE.

Lient. Col. P. C. Hains, 1886-'—. Reports, '88, 789; '89, 989.

**Legislation.**

Purchase and reconstruction of bridge authorized by act of June 21, 1886, '88, 789, 790.

**Operations.**

1887-'88. Removal of old and erection of new bridge nearly completed, '88, 792.

1888-'89. Reconstruction work completed, '89, 989.

**Plans.**

General features of proposed reconstruction, '88, 790.

**BRIDGE at Arthur Kill.—STATEN ISLAND SOUND.**

(Continued from Vol. II, p. 75.)

**Commerce.**

Dimensions of tows, '88, 2424.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 306, 2421.

BOARD OF ENGINEERS.

Convened at New York City, April 10, 1888, by Special Orders Nos. 8 and 9, to examine and report upon Staten Island Bridge. Report, '88, 2423, 2429 (Col. Casey and Lient. Cols. Robert and Hains).

Minority report, '88, 2426 (Maj. King and Capt. Maguire).

**Legislation.**

Act authorizing construction of bridge at Arthur Kill, '88, 2425.

**Plans.**

Description of alterations as proposed by the Board, '88, 2425.

**BRIDGE of the Ohio Connecting R. R. Co., near the mouth of Corks Run.—ACROSS THE OHIO RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309, 2498, 2504, 2506.

BOARD OF ENGINEERS.

Convened at Washington, June 25, 1887, by S. O. No. 60, to consider and report upon plans for the proposed bridge across the Ohio River, about 1 mile below the junction of the Allegheny and Monongahela rivers, submitted by the Ohio Connecting Railroad Company. Report, '88, 2499. (Lient. Cols. Merrill and Barlow, Maj. Stickney, and Lient. Spencer.) Second report of Board, '88, 2505. (Lient. Cols. Merrill and Barlow, and Maj. Stickney.)

**Legislation.**

Bridge authorized by acts of December 17, 1872, and February 14, 1883, '88, 2498.

**Plans.**

The Board of 1887 recommended in their report of June 25 that the site selected by the bridge company be accepted on condition that the axis of the bridge be changed to lie at right angles to the line of the current, and that the channel space be increased to 800 feet; but that otherwise the site be rejected, '88, 2502.

Revised plans being submitted, the latter were approved by the Board on October 4, 1887, '88, 2506.

**BRIDGE at Dubuque, Iowa.—ACROSS THE MISSISSIPPI RIVER.****Commerce.**

Dimensions of the largest Mississippi packet boats, '88, 2496.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309.

**BRIDGE at Dubuque, Iowa.—Continued.****Legislation.**

Bridge authorized by act of February 21, 1887, '88, 2493.

**Plans.**

Maj. Mackenzie considers that the dimensions of the bridge spans are such as to furnish no obstruction to the passage of the largest Mississippi boats, '88, 2496-97.

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**BRIDGE of the Georgia Pacific R. R. Co.—ACROSS THE SUNFLOWER AND YAZOO RIVERS.****Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309, 2488.

**Legislation.**

Bridge authorized by act of March 3, 1887, '88, 2488.

**Plans.**

Capt. Willard approves of proposed bridge dimensions with the recommendation that the draw opening be increased from 115 feet in the clear to 125 feet, '88, 2488.

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**BRIDGE of the Memphis and Charleston R. R. Co. at Chattanooga.—ACROSS THE TENNESSEE RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309, 2513.

**Legislation.**

Bridge authorized by act of February 28, 1887, '88, 2510.

**Plans.**

Lieut. Col. Barlow considered that the modified plans submitted, giving 270 feet in the clear, would afford no obstacle to existing navigation, '88, 2512.

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**BRIDGE at Westfield, N. Y.—ACROSS THE STATEN ISLAND SOUND.****Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 308.

BOARD OF ENGINEERS.

Convened at New York City, April 10, 1888, by Special Orders Nos. 8 and 9, to examine and report upon construction of a bridge at Westfield, N. Y., across Staten Island Sound. Report, '88, 2430. (Col. Casey, Lieut. Col. Robert and Hains, Maj. King, and Capt. Maguire.)

**Plans.**

The Board report adversely to a draw and recommend a cantilever bridge of three bays, the center bay to be not less than 900 feet in the clear, with a clear height over the channel way at mean high water of 150 feet, '88, 2430.

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**BRIDGE of the Georgia Pacific R. R. Co. at Waverly, Ga.—ACROSS THE TOMBIGEE RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309, 2508.

**Legislation.**

Bridge authorized by act of March 3, 1887, '88, 2508.

**Plans.**

Bridge as proposed not considered an obstruction to navigation, '88, 2508.



**BRIDGE of the Kansas City and Memphis Railroad and Bridge Co. at Memphis.—ACROSS THE MISSISSIPPI RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309.

BOARD OF ENGINEERS.

Convened at Memphis, May 26, 1888, by Special Orders No. 26, to examine and report upon the plans of the proposed bridge across the Mississippi River at Memphis. Majority report in favor of a main span of 1,000 feet, two other spans of 600 feet each, and the whole structure to be 75 feet above high water, '88, 2517, 2522. (Maj. Ernst, Capt. Kingman, and Capt. Gillette.) Minority report in favor of a main span of 700 feet, '88, 2521. (Lieut. Col. Merrill.) Secretary of War decides in favor of a main span of 770 feet, '88, 2516.

**BRIDGE between North Hero and Alburgh.—ACROSS LAKE CHAMPLAIN.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 398, 2432.

**Legislation.**

Bridge authorized by act of June 20, 1884, '88, 2431.

**Plans.**

Maj. Adams did not consider the bridge an obstruction to navigation, '88, 2432-33.

**BRIDGE of Kansas City, Topeka and Western R. R. Co.—ACROSS THE MISSOURI RIVER AT SIBLEY.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 308, 2435.

**Legislation.**

Bridge authorized by act of July 3, 1884, '88, 2434.

**Plans.**

In 1887 Lieut. Col. Suter did not consider that the bridge would form any obstruction to navigation, '88, 2436.

**BRIDGE of the Chicago, St. Louis and New Orleans R. R. Co. at East Cairo, Ky.—ACROSS THE OHIO RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 308, 2437.

**Plans.**

Description of proposed bridge, '88, 2436.

**BRIDGE (WAGON) near Nashville, Tenn.—ACROSS THE CUMBERLAND RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 308, 2439.

**Plans.**

Description of proposed bridge, '88, 2440. Modification made and approved, '88, 2441. Lieut. Col. Barlow did not consider that the bridge as proposed would form any obstruction to navigation, '88, 2441.

**BRIDGE of the Ohio River R. R. Co. at Point Pleasant, W. Va.—**  
ACROSS THE GREAT KANAWHA RIVER.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 308.

BOARD OF ENGINEERS.

The Board of 1887, recommended location of bridge with a clear opening of 460 feet, as proposed by the Ohio River Railroad Company, '88, 2448. (Col. Craig-hill, Lieut. Col. Merrill, and Maj. Post.)

**Legislation.**

Act authorizing construction of bridge, March 3, 1887, '88, 2447.

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**BRIDGE to connect Belle Isle Park with the mainland.—**  
ACROSS WEST CHANNEL OF THE DETROIT RIVER.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 308.

**Legislation.**

Bridge authorized by act of July 20, 1886, '88, 2456.

**Plans.**

Proposed location and dimensions of bridge and approaches, '88, 2452.

Lieut. Col. Poe approved of location and construction of bridge as designed, '88, 2451.

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**BRIDGE (INTERNATIONAL) of the Sault Sainte Marie Bridge Co.—**  
ACROSS SAINTE MARIE RIVER.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 308.

**Plans.**

Lieut. Col. Poe approves of location of bridge as proposed, '88, 2458.

**Legislation.**

Bridge authorized by act of July 8, 1882, '88, 2461.

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**BRIDGE of the Nebraska R. R. Co. at Nebraska City.—ACROSS**  
THE MISSOURI RIVER.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 308.

**Legislation.**

Bridge authorized by act of June 4, 1872, '88, 2464.

**Plan.**

Lieut. Col. Suter approves the location and dimensions of the proposed bridge, with the exception that the proposed height be increased from 48 to 50 feet above extreme high water, '88, 2465.

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**BRIDGE (RAILWAY AND WAGON) of the Omaha and Council Bluffs**  
**Railroad and Bridge Co., between Omaha and Council**  
**Bluffs.—ACROSS THE MISSOURI RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309.

**Legislation.**

Bridge authorized by act of March 3, 1887, '88, 2467.

**Plans.**

Maj. Raymond did not consider that the bridge as proposed would interfere with the existing requirements of navigation, '88, 2469.

**BRIDGE of the New York and Long Island Bridge Co., between New York City and Long Island.—ACROSS THE EAST RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309.

**Legislation.**

Bridge authorized by act of March 3, 1887, '88, 2471.

**Plans.**

Plan and location of proposed bridge approved by Secretary of War, '88, 2472.

**BRIDGE of the Sioux City Bridge Co. at Sioux City, Iowa.—ACROSS THE MISSOURI RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309.

**Legislation.**

Bridge authorized by act of August 15, 1886, '88, 2477.

**Plans.**

Dimensions of proposed bridge, '88, 2476.

Lieut. Col. Suter considers the proposed span of 400 feet, with a treadway of 50 feet, amply sufficient for the requirements of navigation, '88, 2477.

**BRIDGE of the Ohio Valley R. R. Co.—ACROSS THE TRADEWATER RIVER, KY.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309.

**Legislation.**

Bridge authorized by act of February 21, 1887, '88, 2472.

**Plans.**

Description of proposed bridge, '88, 2473.

Maj. Stickney reports that the bridge, when finished as proposed, will present no material obstacle to navigation, '88, 2473.

**BRIDGE of the Central Railroad and Bridge Co., between Cincinnati, Ohio, and Newport, Ky.—ACROSS THE OHIO RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 309, 2482.

BOARD OF ENGINEERS.

Convened at Cincinnati, March 17, 1888, by Special Orders No. 11, to examine and report upon plans and location of proposed bridge across the Ohio River between Cincinnati, Ohio, and Newport, Ky. Report, '88, 2483. (Lieut. Col. Poe and Majs. Stickney and Mackenzie.)

**Plans.**

Description of proposed bridge, '88, 2482.

The Board of 1888 recommended the approval of the plans and location of proposed bridge as set forth by the Central Railroad and Bridge Company, '88, 2484.

**BRIDGE of the Savannah, Florida and Western R. R. Co. at Doctor Town, Ga.—ACROSS THE ALTAMAHA RIVER.**

**Engineers.**

ENGINEER IN CHARGE.

Col. Q. A. Gillmore. Report, '88, 2549.

**Plans.**

Col. Gillmore reports this bridge as without a draw, and an obstruction to the navigation of the stream, '88, 2550.

**BRIDGE of the Montgomery, Tuscaloosa and Memphis R. R. Co. near Montgomery, Ala.—ACROSS THE ALABAMA RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 336.

**Plans.**

Plan and location submitted and approved by Secretary of War, July 11, 1889, '90, 336.

**BRIDGE of the Kansas City, Arkansas and New Orleans R. R. Co. at Cummings Landing, Ark.—ACROSS THE ARKANSAS RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 337.

**Plans.**

Plan and location submitted and approved by Secretary of War, February 25, 1890, '90, 337.

**BRIDGE of the Kansas and Arkansas Valley R. R. Co. at Fort Smith, Ark.—ACROSS THE ARKANSAS RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 338.

**Plans.**

Plan and location submitted and approved by Secretary of War, May 17, 1890, '90, 338.

**BRIDGES crossing the Ashley, Edisto, Salkahatchie, Cheehan, Savannah, and Altamaha rivers, and St. Augustine Creek, Ga. and S. C.****Engineers.**

ENGINEER IN CHARGE.

Col. Q. A. Gillmore. Report, '88, 2629, 2663.

**Plans.**

Description of the bridges and of the modifications proposed therein, '88, 2630.

Modifications suggested by Col. Gillmore in such of these structures as obstruct navigation, '88, 2663.

**BRIDGE across the channel leading to Back Cove at Portland, Me.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 343.

**Legislation.**

Notice as to authorities required, '90, 343.

**BRIDGES, two railroad and two county.—ACROSS THE BIG BLACK RIVER, MISS.****Engineers.**

ENGINEER IN CHARGE.

Capt. E. Bergland. Report, '88, 2554.

**Plans.**

Description of Louisville, New Orleans and Texas Railroad bridge. An obstruction at all stages of water. Center span should be made a pivot draw. The two county bridges should be changed to drawbridges. Description of Vicksburg and Meridian Railroad bridge. Authorized by act of State legislature of 1866. An obstruction at all stages. One of the piers should be replaced by a pivot pier and two of the spans by a pivot draw, '88, 2554.

**BRIDGE of the Northern Pacific R. R. Co.—ACROSS THE BIG HORN RIVER, MONT.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. C. B. Sears. Report, '88, 2670.

**Plans.**

Capt. Sears reports that the bridge in its present condition is an obstruction, and should be provided with a draw giving a free channel way of 100 feet width, '88, 2670.

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**BRIDGE of the Chesapeake and Ohio R. R. Co.—NEAR THE MOUTH OF THE BIG SANDY RIVER, W. VA.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. J. C. Post. Report, '88, 2578.

**Plans.**

Capt. Post recommended the removal of pile and coffer dam obstructions about one of the piers, '88, 2578.

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**BRIDGE of the Philadelphia, Wilmington and Baltimore R. R. Co., near Laurel, Del.—ACROSS BROAD CREEK.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 335.

**Plans.**

Alteration of bridge draw made as required by act of June 6, 1888, '90, 335.

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**BRIDGES of the Selma and New Orleans R. R. and the Alabama Central R. R.—ACROSS THE CAHABA RIVER, ALA. (8 AND 16 MILES ABOVE ITS MOUTH).**

**Engineers.**

ENGINEERS IN CHARGE.

Maj. A. N. Damrell. Report, '88, 2551.

Capt. R. L. Hoxie. Report, '88, 2553.

**Plans.**

Descriptions of the bridges, '88, 2550.

Maj. Damrell reports both bridges fixed structures, impassable during the navigable stage of the river, and recommends their reconstruction with draw openings of 100 feet, '88, 2551, 2553.

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**BRIDGES across the Calumet River, Ill.**

**Engineers.**

ENGINEER IN CHARGE.

Maj. T. H. Handbury. Report, '88, 2582, 2650.

**Plans.**

List of bridges forming an obstruction to the river, with changes suggested for each, '88, 2583, 2651.

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**BRIDGE of the Nashville and Knoxville R. R. Co., between Smith and Putnam counties, Tenn.—ACROSS THE CANEY FORK RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 337.

**Plans.**

Plan and location submitted, and approved by Secretary of War, December 12, 1889, '90, 337.

**BRIDGES of the Boston and Maine and the Eastern and Boston and Lowell Railroads, between the river's mouth and East Cambridge.—ACROSS THE CHARLES RIVER.**

**Engineers.**

ENGINEER IN CHARGE.

Maj. C. W. Raymond. Report, '88, 2528.

**Plans.**

Delays in opening draws, caused by frequent passage of trains, which can not be obviated by any practical alteration of the bridges, '88, 2528.

**BRIDGES across the Charles River, Mass.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 340.

BOARD OF ENGINEERS.

Convened at Boston, Mass., February 1, 1890, by Special Order No. 82, to report upon the bridges crossing Charles River which interfere with navigation. The Board reported the draw openings of the Charles River and Warren bridges as of insufficient width, but did not recommend that any reconstruction be at present required, '90, 3482. Descriptions of existing bridges, '90, 3471, 3474.

**Commerce.**

Commercial interests affected, '90, 3474.

**Legislation.**

Notices served upon bridge owners as to alterations required, '90, 340.

**BRIDGES (TWO WAGON BRIDGES, AND THE SOUTHWESTERN RAILROAD BRIDGE) at Eufaula and Fort Gaines, Ga. and Ala.—ACROSS THE CHATTAHOOCHEE RIVER.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. R. L. Hoxie. Report, '88, 2553.

**Plans.**

The introduction of a draw of suitable width with sheer booms recommended in each case, '88, 2553.

**BRIDGE across the Chicago River at Canal street, Chicago, Ill.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 436.

BOARD OF ENGINEERS.

Convened by S. O. No. 39, to examine and report upon bridge across the Chicago River and Canal street. The Board recommended (1) the removal of the present pivot pier, the protection wings or bridge rests, and all the adjuncts to the existing construction now obstructing navigation; (2) the postponement of further construction until the river shall have been so widened as to provide for the full opening of the south draw; (3) that provision be made when the bridge is restored for maneuvering it by steam power, '91, 3864. (Majs. Ludlow and Davis and Capt. Marshall.)

**BRIDGE (RAILWAY) at Hudson City, Wis.—ACROSS LAKE SAINT CROIX.  
BRIDGE (HIGHWAY) at Durand, Wis.—ACROSS THE CHIPPEWA RIVER.**

**Engineers.**

ENGINEER IN CHARGE.

Maj. C. J. Allen. Report, '88, 2637.

**Plans.**

Maj. Allen reports that sheer booms should be placed to assist vessels in passing the spans, '88, 2637.

**BRIDGES (TWO WAGON) near Geneva and below Newton, Ala.—**  
ACROSS THE CHOCTAWHATCHIE RIVER.

**Engineers.**

ENGINEER IN CHARGE.

Capt. R. L. Hoxie. Report, '88, 2553.

**Plans.**

Capt. Hoxie reports that both bridges must be removed if river improvements are carried out, '88, 2553.

**BRIDGES at Wilmington, Del.—ACROSS THE CHRISTIANA AND THE**  
SAINT JONES RIVERS.

**Engineers.**

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent. Report, '88, 2538, 2659.

**Plans.**

Mr. Smith reported that the draw of the Christiana Bridge should be worked by steam or some mechanical power, and that turning machinery should be put in both bridges over the Saint Jones River, '88, 2538, 2660.

**BRIDGES of the New York, New Haven and Hartford R. R.**  
Co.—(1) AT COS COB, CONN.; (2) BRIDGEPORT, CONN.; (3) THE HOUSATONIC RIVER, CONN.; (4) NEW HAVEN, ON THE QUINNIPIAC RIVER, CONN.; (5) MIDDLETOWN, ON THE CONNECTICUT RIVER, CONN.; (6) THE CITY BRIDGES AT BRIDGEPORT; (7, 8) THE CITY AND THE TOMLINSON BRIDGES AT NEW HAVEN, CONN.

**Commerce.**

Protests of commercial interests against bridges 2, 4, 5, 7, and 8, '88, 2535, 2537.

**Engineers.**

ENGINEER IN CHARGE.

Lieut. Col. W. McFarland. Report, '88, 2532.

**Plans.**

Lieut. Col. W. McFarland proposed to widen the clear way at bridges 3 and 5 by removal of certain under-water portions of the piers; to require the introduction of draws at bridges 4 and 7, and the widening of the existing draw at bridge 8, and to secure a more expeditious opening and closing of the draws at bridges 1 and 2 by the application of steam power, '88, 2532, 2534.

**BRIDGE at Detroit, Mich.—ACROSS THE DETROIT RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 3456.

BOARD OF ENGINEERS.

Convened at Detroit, Mich., July 19, 1889, by S. O. No. 15, to report upon the practicability and necessity of a bridge over Detroit River at Detroit. The Board reported the construction of such a bridge feasible, and of the projects submitted to them recommended that for a high bridge. (See description No. 2 on p. 3460.) Report, '90, 3456, 3463. (Col. Poe and Majs. Allen and Adams.)

**Commerce.**

Shipping interests, '90, 3457.

**BRIDGES of the Norfolk and Western R. R. Co. at Norfolk,**  
Va.—ACROSS THE EASTERN AND SOUTHERN BRANCHES OF ELIZABETH RIVER,  
VA.

**Engineers.**

ENGINEER IN CHARGE.

Capt. F. A. Hinman. Report, '88, 2542, 2543, 2622.

**Plans.**

Details of modification of bridge as proposed by the railroad company, '88, 2623. Correspondence in relation thereto, '88, 2624-2628. Present draw opening too narrow and badly located. Draw openings should be 60 feet wide and relocated at the deep channel, '88, 2543.

**BRIDGES at Charleston, W. Va.** (SUSPENSION WAGON BRIDGE AND OHIO CENTRAL R. R. BRIDGE).—ACROSS THE ELK RIVER.**Engineers.**

ENGINEER IN CHARGE.

Lieut. Col. W. P. Craighill. Report, '88, 2570.

**Plans.**

Description, '88, 2572.

In view of the nature of the present navigation and the limited improvement undertaken by the United States, Lieut. Col. Craighill did not consider any action necessary in regard to these structures, '88, 2574.

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**BRIDGE (WAGON) at Drayton, Ga.**—ACROSS THE FLINT RIVER.**Engineers.**

ENGINEER IN CHARGE.

Capt. R. L. Hoxie. Report, '88, 2552.

**Plans.**

Capt. Hoxie recommends the insertion of a draw of suitable width, '88, 2552.

**BRIDGE of the Old Colony R. R. Co. at Boston, Mass.**—ACROSS FORT POINT CHANNEL.**Engineers.**

ENGINEER IN CHARGE.

Maj. C. W. Raymond. Report, '88, 2527.

**Plans.**

Maj. Raymond reports that the interference with free navigation is caused by the delay in opening the draws, due to the great number of passing trains, and that no alteration of the bridge is necessary, '88, 2527.

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**BRIDGE of the New York and New England R. R. Co. at Boston, Mass.**—ACROSS THE FORT POINT CHANNEL.**Engineers.**

ENGINEERS IN CHARGE.

Maj. C. W. Raymond. Report, '88, 2527.

Lieut. Col. G. L. Gillespie. Report, '88, 2608.

**Plans.**

Maj. Raymond proposed to widen the draw openings to a least width of 42½ feet and to change the direction of the draw pier, '88, 2527.

Lieut. Col. Gillespie reported that to provide for the projected increase in channel depth the existing pivot pier would have to be reconstructed with draw openings of 43 feet, '88, 2609.

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**BRIDGES across the Fox River and the Portage Canal, Wis.****Engineers.**

ENGINEER IN CHARGE.

Capt. W. L. Marshall. Report, '88, 2579.

**Plans.**

List of bridges obstructing the river and the canal; remedies or modifications proposed by Capt. Marshall, '88, 2578.



**BRIDGE of the Missouri Pacific R. R. Co.—ACROSS THE GASCONADE RIVER, MO.**

**Engineers.**

ENGINEER IN CHARGE.

Maj. A. M. Miller. Report, '88, 2559.

**Plans.**

Description of the bridge, '88, 2559. Maj. Miller reports that the drawspan should be made operative and a guide pier built above and below the pivot pier, '88, 2559.

**BRIDGE of the Wilmington, Columbia and Augusta R. R. Co., 125 miles above Georgetown, S. C.—ACROSS THE GREAT PEDEE RIVER.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. W. H. Bixby. Report, '88, 2547.

**Plans.**

Capt. Bixby recommends the provision of suitable fenders at both ends of the draw openings of the bridge, extending 100 feet above and below the bridge, '88, 2547.

**BRIDGES across the Harlem River, New York City.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 344.

BOARD OF ENGINEERS.

Convened at New York City, June 19, 1890, by S. O. No. 25, to report upon alleged obstruction of navigation by certain bridges over the Harlem River. The Board recommended increasing the clear headway of the Third and Fourth Avenue bridges to 24 feet above high-water level, '90, 3487. (Cols. Abbot and Comstock and Lieut. Col. Gillespie.)

**Commerce.**

Commercial interest involved, '90, 3486.

**Legislation.**

Notice served as to alterations required, '90, 344.

**BRIDGE (HIGHWAY) at Stratford, Conn.—ACROSS THE HOUSATONIC RIVER.**

**Engineers.**

ENGINEER IN CHARGE.

Lieut. Col. D. C. Houston. Report, '88, 2611.

**Plans.**

Description, '88, 2612.

Lieut. Col. Houston recommends that the fifth and sixth spans be made draw-spans, '88, 2612.

**BRIDGE across the Hudson River at New York City.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 433.

BOARD OF ENGINEERS.

Convened to consider and report upon plan of bridge, '91, 3853. The Board recommended that the clear headway at the middle of the span above high water of spring tides be increased in the plans to not less than 150 feet, '91, 3853. (Cols. Abbot, Comstock, and Houston, and Lieut. Col. Gillespie.)

**Legislation.**

Bridge authorized by act of July 11, 1890; requirements of the act, '91, 3853.

**BRIDGES across the Kentucky River, Ky.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 342.

ENGINEER IN CHARGE.

Capt. J. C. Post. Report, '88, 2574.

**Legislation.**

Notice served as to alterations required, '90, 342.

**Plans.**

Location and dimensions of bridges crossing the improved portion of the Kentucky River, '88, 2574.

Bridge at Worthville and two at Frankfort restrict navigation, and Capt. Post recommends that they be raised or rebuilt, '88, 2575, 2576.

**BRIDGE at North Hero, Vt.—ACROSS THE LAKE CHAMPLAIN CHANNEL.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 336.

**Plans.**

Plans submitted and approved July 2, 1889, '90, 336.

**BRIDGE at Parkersburg, W. Va.—ACROSS THE LITTLE KANAWHA RIVER.****Engineers.**

ENGINEER IN CHARGE.

Maj. J. C. Post. Report, '88, 2649.

**Plans.**

The bridge destroys a former landing of Ohio River steamers, and prevents the use of the mouth of the river as an ice harbor, '88, 2649.

**BRIDGE (COUNTY) at Parkersburg, W. Va.—ACROSS THE LITTLE KANAWHA RIVER.****Engineers.**

ENGINEER IN CHARGE.

Capt. J. C. Post. Report, '88, 2577.

**Plans.**

Description, '88, 2577.

Capt. Post recommends that it be converted into a drawbridge by building a middle pier, '88, 2577.

**BRIDGES (NORTH PACIFIC R. R. BRIDGE AND WAGON BRIDGE) at Portland, Oreg.—ACROSS THE LOWER WILLAMETTE RIVER.****Engineers.**

ENGINEER IN CHARGE.

Capt. C. F. Powell. Report, '88, 2593.

**Plans.**

Capt. Powell reported both structures a menace to navigation and considered that both should be wholly removed, '88, 2593.

**BRIDGES across Lumber River, N. C.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 343.

**Legislation.**

Notices served as to alterations required, '90, 343.

**BRIDGE of the Lamolle Valley Extension R. R. Co.—ACROSS  
MISSISQUOY BAY, VT.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 343.

ENGINEER IN CHARGE.

Maj. M. B. Adams. Report, '88, 2652.

**Plans.**

Maj. Adams recommends the removal of the bridge, it being no longer in use and being a great obstruction on account of the narrowness of the draw, '88, 2652.

**Legislation.**

Notice served as to alteration required, '90, 344.

**BRIDGE (CITY) at La Crosse, Wis.—ACROSS THE MISSISSIPPI RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 336.

**Plans.**

Plan and location submitted, and approved by Secretary of War September 30, 1889, '90, 336.

**BRIDGES across the Monongahela, Allegheny, and at the  
lower end of the Muskingum rivers.**

**Engineers.**

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill. Report, '88, 2566.

**Plans.**

Tabular statement of all bridges, with dimensions thereof, over the navigable portions of the Monongahela and Allegheny rivers, '88, 2566, 2568.

Bridges on the Monongahela and Allegheny requiring modification, '88, 2567, 2569.

**BRIDGE across the Mississippi River at or near New Or-  
leans, La.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 3453.

BOARD OF ENGINEERS.

Convened at New Orleans, La., June 14, 1890, by S. O. No. 29, to report upon the erection of a high-level bridge across the Mississippi near New Orleans. The Board reported that no bridge should be built at or below the city, but that one could be built above the city without serious obstruction to navigation, '90, 3454. (Col. Comstock, Lieut. Col. Suter, Majs. Ernst and Allen, and Capt. Kingman.)

**Commerce.**

Commercial interests affected, '90, 3455.

**BRIDGES across the Mississippi River above and below New  
Orleans, La.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 3450.

BOARD OF ENGINEERS.

Convened at New Orleans, La., November 30, 1889, by S. O. No. 47, to report upon the question of the erection of bridges across the Mississippi above and below New Orleans. The Board reported that any bridge across this portion of the river would be an obstruction, and that but one bridge was needed for railway purposes at New Orleans, and that should be located above the city, '90, 3457. (Col. Comstock, Maj. Allen, and Capt. Kingman.)

**Commerce.**

Commercial interests involved, '90, 3451.

**BRIDGES crossing the Mississippi River.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 338.

**Legislation.**

Act of August 11, 1888, providing for alteration of structures impeding navigation, '90, 338.

Notice served upon various bridge owners, requiring alterations, '90, 339.

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**BRIDGE of the Muscatine Bridge Co., at Muscatine, Iowa.—  
ACROSS THE MISSISSIPPI RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 336.

**Plans.**

Plan and location submitted by the company, and approved by Secretary of War June 11, 1889, '90, 336.

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**BRIDGE of the Lyons and Fulton Bridge Co., at Lyons, Iowa.—ACROSS THE MISSISSIPPI RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 337.

**Plans.**

Plan and location submitted, and approved by Secretary of War April 22, 1890, '90, 338.

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**BRIDGE (CITY) at Nebraska City, Nebr.—ACROSS THE MISSOURI RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 337.

**Plans.**

Plan and location submitted, and approved by Secretary of War April 3, 1890, '90, 337.

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**BRIDGE of the Nebraska Central R. R. Co. at Omaha, Nebr.—  
ACROSS THE MISSOURI RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 337.

**Plans.**

Plan and location submitted, and approved by Secretary of War February 27, 1890, '90, 337.

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**BRIDGE of the St. Louis, Keokuk and Northwestern R. R. Co.  
at Bellefontaine Bluffs, Mo.—ACROSS THE MISSOURI RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 337.

**Plans.**

Plan and location submitted, and approved by Secretary of War December 21, 1889, '90, 337.

**BRIDGE of the Pacific Short Line Bridge Co. at Sioux City, Iowa.—ACROSS THE MISSOURI RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 338.

**Plans.**

Plan and location submitted, and approved by Secretary of War June 26, 1890, '90, 338.

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**BRIDGE over Murderer's Creek, N. Y.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 342.

**Legislation.**

Notice served as to alterations required, '90, 342.

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**BRIDGE (COUNTY) at Zanesville, Ohio.—ACROSS THE MUSKINGUM RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 336.

**Plans.**

Plans and location submitted, and approved by Secretary of War August 5, 1889, '90, 336.

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**BRIDGES across the Muskingum River, Ohio.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 341.

**Legislation.**

Notice served as to alterations required, '90, 341.

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**BRIDGES of the Richmond and Danville R. R. Co.—ACROSS THE PAMUNKEY RIVER, VA., and at White House, and the Alexandria and Fredericksburg R. R. Co.—ACROSS THE MABSCO CREEK, VA.**

**Engineers.**

ENGINEER IN CHARGE.

Mr. S. T. Abert, U. S. agent. Report, '88, 2621.

**Plans.**

Mr. Abert reports that the complaint in both cases is that the draw is too narrow, and that vessels in passing are swept against the sides thereof, '88, 2621.

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**BRIDGE of the Atlantic and North Carolina R. R. Co. at Kingston, N. C.—ACROSS THE NEUSE RIVER.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. Bixby reported the bridge no obstruction to navigation, '88, 2545.

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**BRIDGE of the Wilmington and Weldon R. R. Co., near Goldsboro, N. C.—ACROSS THE NEUSE RIVER.**

**Plans.**

Capt. Bixby recommended that the bridge be permitted to remain in its present condition, provided the owners would clear away the obstructing portion of the old pier beneath, '88, 2545.

**BRIDGE of the Wilmington, Columbia and Augusta R. R. Co., above Wilmington, N. C.—ACROSS NORTH EAST CAPE FEAR RIVER.****Plans.**

Capt. Bixby recommends the removal of a sunken pier obstructing the draw, at the expense of the United States, and that the railroad company be required to provide suitable fenders for the draw opening, '88, 2547.

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**BRIDGES of the East Tennessee, Virginia and Georgia R. R., above Hawkinsville and below Macon, Ga.—ACROSS THE OCMULGEE RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 343.

ENGINEER IN CHARGE.

Capt. R. L. Hoxie. Report, '88, 2552.

**Plans.**

Capt. Hoxie recommends the insertion of 60-foot draws in each bridge, '88, 2552.

**Legislation.**

Notices served as to alterations required, '90, 343.

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**BRIDGE of the Central R. R. above Dublin, Ga.—ACROSS THE OCONEE RIVER.****Engineers.**

ENGINEER IN CHARGE.

Capt. R. L. Hoxie. Report, '88, 2552.

**Plans.**

Capt. Hoxie recommends the insertion of a draw with 60 feet clear span, '88, 2552.

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**BRIDGE across the Oconee River, Ga.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 344.

**Legislation.**

Notice served as to alterations required, '90, 344.

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**BRIDGE of the Wheeling Bridge Co. at Wheeling, W. Va.—ACROSS THE OHIO RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 336.

**Plans.**

Plan and location submitted, and approved by Secretary of War October 26, 1889, '90, 337.

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**BRIDGES of the West Virginia and Ironton R. R. Co. below Ceredo, W. Va.—ACROSS THE OHIO RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 337.

**Plans.**

Plan and location submitted, and approved by Secretary of War December 24, 1889, '90, 337.

**BRIDGE of the Louisville and Jeffersonville Bridge Co., between Louisville, Ky., and Jeffersonville, Ind.—ACROSS THE OHIO RIVER.**

**Plans.**

Recommendations by Board of Engineers, '90, 335. Modified plan submitted by the company, and approved by Secretary of War January 29, 1890, '90, 336.

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**BRIDGES crossing the Ohio, the Monongahela, the Allegheny, the Muskingum, the Big Sandy, the Guyandotte, the Little Kanawha, and the Buckhannon rivers.**

**Engineers.**

**ENGINEER IN CHARGE.**

Lieut. Col. W. E. Merrill. Report, '88, 2672.

**ASSISTANT.**

Lieut. L. Beach. Report, '88, 2677.

**Plans.**

List of bridges, with location, dimensions, and channel span in the clear, on the Ohio, '88, 2673; the Monongahela, '88, 2674; the Allegheny, '88, 2675.

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**BRIDGE between Louisville, Ky., and Jeffersonville, Ind.—ACROSS THE OHIO RIVER.**

**Engineers.**

**CHIEF OF ENGINEERS.**

Report, '90, 3467.

**BOARD OF ENGINEERS.**

Convened at Louisville, Ky., September 14, 1889, by S. O. No. 34, to report on plans and location of proposed bridge. The Board recommended that the proposed bridge be located at or above Wall street, with two channel spans of 500 feet in the clear, '90, 3470. (Col. Comstock, Lieut. Col. Suter, and Maj. Allen.)

**Commerce.**

Commercial interests involved, '90, 3469.

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**BRIDGE at Providence, R. I.—ACROSS THE PAWTUCKET RIVER.**

**Engineers.**

**ENGINEER IN CHARGE.**

Lieut. Col. G. H. Elliott. Report, '88, 2528.

**Legislation.**

Act of State legislature, January, 1883, requiring the reconstruction of the bridge with a swing draw, with openings on each side of 80 feet, '88, 2529.

**Plans.**

New bridge in process of construction, '88, 2529.

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**BRIDGE of the Boston and Providence R. R. Co.—ACROSS THE PAWTUCKET RIVER.**

**Engineers.**

**ENGINEER IN CHARGE.**

Lieut. Col. G. H. Elliott. Report, '88, 2529.

**Commerce.**

Obstruction caused by the bridge to commerce of Pawtucket, '88, 2529.

**Legislation.**

Resolution of State legislature, May 29, 1884, appointing a committee to report upon bridges obstructing the river, '88, 2530.

**Plans.**

Description of the bridge, '88, 2529. Lieut. Col. Elliott reported the available draw opening too narrow and considered that there should be two, '88, 2530.

**BRIDGES crossing the Petit Jean, Cache, Saint Francis, Arkansas, Saline, and Poteau rivers.****Engineers.**

ENGINEER IN CHARGE.

Capt. H. S. Taber. Report, '88, 2635.

**Plans.**

Capt. Taber reports that all of these bridges interfere with a present or prospective improvement of the streams caused by them, '88, 2635.

**LONG BRIDGE at Washington, D. C.—ACROSS THE POTOMAC RIVER****Engineers.**

ENGINEER IN CHARGE.

Maj. P. C. Hains. Report, '88, 2539.

**Plans.**

Condition of the bridge in 1884. An obstruction to the further improvement of the Potomac River, '88, 2539.

**BRIDGE (AQUEDUCT) at Washington, D. C.—ACROSS THE POTOMAC RIVER.****Engineers.**

ENGINEER IN CHARGE.

Maj. P. C. Hains. Report, '88, 2541.

**Commerce.**

The bridge an obstruction to the commercial interests of the river, '88, 2541.

**Plans.**

Referred to Maj. Hains for examination and report. Recommended that the use of the bridge as an aqueduct be discontinued, and that a draw be provided, '88, 2541.

**BRIDGE (IN PROCESS OF CONSTRUCTION) at Butte City, Cal.—ACROSS THE SACRAMENTO RIVER.****Engineers.**

ENGINEER IN CHARGE.

Capt. A. H. Payson. Report, '88, 2653.

**Plans.**

Capt. Payson reports that the bridge, if built at the locality contemplated, will form a serious obstruction to navigation, '88, 2652.

**BRIDGE across the Saint Francis River, Ark.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 342.

**Legislation.**

Notice served as to alterations required, '90, 342.

**BRIDGE (RAILWAY) near Saint Joseph, Mich.—ACROSS THE SAINT JOSEPH RIVER.****Engineers.**

ENGINEER IN CHARGE.

Capt. D. W. Lockwood. Report, '88, 2585.

**Plans.**

Description of the bridge, '88, 2585. Capt. Lockwood proposed to replace the existing south draw with a pivot draw having clear openings of 100 feet, '88, 2586.



**BRIDGE of the Chicago and West Michigan R. R. Co.—ACROSS THE SAINT JOSEPH RIVER, MICH.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 340.

**Legislation.**

Notice served upon the company as to required modifications, '90, 341.

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**BRIDGE from Grassy Point, Minn.—ACROSS THE SAINT LOUIS RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 342.

**Legislation.**

Notice served as to required alteration, '90, 342.

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**BRIDGE of the Northeastern R. R. Co.—ACROSS THE SANTEE RIVER, S. C.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. W. H. Bixby. Report, '88, 2548.

**Plans.**

Capt. Bixby recommends that the drawspan openings of the bridge be provided with suitable fenders, '88, 2548.

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**BRIDGES across the Schuylkill River at Philadelphia, Pa., the Bancocas, N. J., the Raccoon, N. J., the Salem, N. J., the North Branch of the Susquehanna, Pa., the thoroughfare between Cape May and Great Bay at Atlantic City, N. J., and across Frankford, Pensauken, Woodbury, Mantua, Darby, Ridley, and Chester creeks, N. J.**

**Engineers.**

ENGINEER-IN-CHARGE.

Lieut. Col. H. M. Robert. Report, '88, 2612.

**Plans.**

Description, '88, 2612.

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**BRIDGES (TWO RAILROAD AND FIVE COUNTY BRIDGES)—ACROSS THE SOUTH FORKED DEER RIVER, TENN.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. E. Bergland. Report, '88, 2554.

**Plans.**

Capt. Bergland recommends the removal of such of the bridges as are unused, and the insertion of draws in the others, '88, 2554.

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**BRIDGES at Wilmington, Del., across Christiana River; at Watsons Island, Md., across the Susquehanna River; below Pocomoke City across the Pocomoke River, Md., and across the inland waterway from Chincoteague Bay, Va., to Delaware, near Lewes, Del.**

**Engineers.**

ENGINEER IN CHARGE.

Mr. W. F. Smith, U. S. agent. Report, '88, 2617, 2619.

**Plans.**

Description of the bridges and of the interference with navigation caused thereby, '88, 2617, 2619.

**BRIDGE between Somerset and Fall River.—ACROSS TAUNTON RIVER, MASS.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 340.

ENGINEER IN CHARGE.

Maj. W. R. Livermore. Report, '88, 2659.

**Plans.**

Maj. Livermore recommends placing the draw protection parallel to the current, and increasing the draw opening, '88, 2659.

**Legislation.**

Notice served as to alterations required, '90, 340.

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**BRIDGES (FIVE) crossing the Tennessee River at Florence, Ala., Decatur, Ala., Bridgeport, Ala., Johnsonville, Tenn., and Gilbertsville, Ky.****Engineers.**

ENGINEER IN CHARGE.

Lieut. Col. J. W. Barlow. Report, '88, 2638.

**Plans.**

Lieut. Col. Barlow reported that the interests of navigation required the abatement or material modification of the Florence Bridge, and that the drawspans of the bridges at Bridgeport, Johnsonville, and Gilbertsville should be enlarged to 150 feet in the clear, '88, 2640.

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**BRIDGE of the Tennessee Midland R. R. Co. at Perryville, Tenn.—ACROSS THE TENNESSEE RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 336.

**Plans.**

Revised plan and location submitted, and approved by Secretary of War August 21, 1889, '90, 336.

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**BRIDGES of the Memphis and Charleston, the Nashville, Chattanooga and St. Louis, and the Chesapeake, Ohio and Southwestern Railroads, crossing the Tennessee River at Florence, Ala., Johnsonville, Tenn., and Gilbertsville, Ky.****Engineers.**

ENGINEER IN CHARGE.

Maj. W. R. King. Report, '88, 2562.

**Plans.**

Maj. King recommends the removal and relocation of the draws in these bridges, '88, 2563.

Tabular statement of bridges on the Tennessee and Cumberland rivers, '88, 2565.

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**BRIDGES across the Tennessee River.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 339.

**Legislation.**

Notice served upon the East Tennessee, Virginia and Georgia, and the Memphis and Charleston Railroad Companies as to required alterations, '90, 339.

**BRIDGE of the New Orleans, Natchez and Fort Scott R. R. Co. at Daniels Ferry, La.—ACROSS TENNESSEE RIVER.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 337.

**Plans.**

Plan and location submitted, and approved by Secretary of War December 19, 1889, '90, 337.

**BRIDGE in Brunswick County, N. C.—ACROSS TOWN CREEK.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. F. A. Hinman. Report, '88, 2543.

**Plans.**

Capt. Hinman reports the bridge a county road bridge without a draw, and recommends the insertion of a proper draw opening or the removal of the bridge, '88, 2543.

**BRIDGE (COUNTY) across Town Creek, N. C.**

**Plans.**

Capt. Bixby recommends that the insertion of a drawspan of 40 feet clear be required, '88, 2546.

**BRIDGE (CITY) at Michigan City, Ind.—ACROSS TRAIL CREEK.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 338.

**Plans.**

Plan and location submitted, and approved by Secretary of War June 4, 1890, '90, 338.

**BRIDGES: (1) Main Street Bridge at La Fayette; (2) Lake Erie and Western R. R. Bridge at La Fayette; (3) Wabash, St. Louis and Pacific R. R. Bridge at Attica; (4) Chicago and Great Southern R. R. Bridge at Attica; (5) Indiana, Bloomington and Western R. R. Bridge at Covington, and Columbus and St. Louis R. R. Bridge near Lodi, Ind.—ACROSS THE WABASH RIVER.**

**Engineers.**

ENGINEER IN CHARGE.

Maj. A. M. Miller. Report, '88, 2556.

**Plans.**

Maj. Miller reports all these bridges complete obstructions to steamboat navigation at and above a medium stage of water, and recommends the insertion of drawspans over the high-water channel, of 60 feet width in the clear, '88, 2557.

**BRIDGES of the South Carolina R. R. and Wilmington, Columbia and Augusta R. R.—ACROSS THE WATEREE RIVER, S. C.**

**Engineers.**

ENGINEER IN CHARGE.

Capt. W. H. Bixby. Report, '88, 2548.

**Legislation.**

Use of South Carolina Railroad Bridge without draw authorized by State acts of 1853 and 1858, '88, 2548.

**Plans.**

Capt. Bixby reports both bridges an obstruction to navigation, and recommends that the insertion of suitable drawspans 60 feet in the clear be required, '88, 2548.

**BRIDGES crossing the Wabash and White rivers, Ind.****Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 341.

ENGINEER IN CHARGE.

Maj. A. Stickney. Report, '88, 2647.

ASSISTANT.

O. L. Petitdidier. Report, '88, 2647.

**Plans.**

List of bridges without draws and forming total obstructions at high stages, '88, 2648. Maj. Stickney recommends that it be made optional with the bridge owners whether they insert a draw and guard pier or raise their bridges enough to obtain 20 feet clearance between the lower cord and high-water mark, '88, 2648.

**BRIDGES (EVANSVILLE AND TERRE HAUTE R. R. AND THE EVANSVILLE AND INDIANAPOLIS R. R.) near Deckers Station, and above the mouth of the West Fork, Ind.—ACROSS THE WHITE RIVER.****Engineers.**

ENGINEER IN CHARGE.

Maj. A. M. Miller. Report, '88, 2558.

**Plans.**

Description of the bridges, '88, 2558. Draw should be placed in the Evansville and Indianapolis Bridge, and the location of the draw in the Evansville and Terre Haute Bridge changed, '88, 2558.

**BRIDGES and ferry cables across the Upper Willamette River, Oreg.****Engineers.**

ENGINEER IN CHARGE.

Maj. W. A. Jones. Report, '88, 2590.

**Plans.**

List of localities at which such obstructions exist, '88, 2590.

**BRIDGES of the Florida Southern, the South Florida, and the Florida Railroad and Navigation Cos., across the Withlacoochee River, and Florida Southern R. R. Co.'s Bridge across Pease River.****Engineers.**

ENGINEER IN CHARGE.

Lieut. W. M. Black. Report, '88, 2630.

**Plans.**

Lieut. Black reports that these bridges will have to be provided with draws if an improvement is undertaken, '88, 2631.

**BROAD AND SALUDA RIVERS, ABOVE COLUMBIA, S. C.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 158.

ENGINEER IN CHARGE.

Capt. F. V. Abbot. Report, '89, 1203.

# **BROAD AND SALUDA RIVERS, ABOVE COLUMBIA, S. C.—** Continued.

## **Physical Characteristics.**

Descriptions of the locality, '89, 1203.

## **Plans.**

In 1889 Capt. Abbot did not consider that the existing commercial requirements warranted an improvement, '89, 1207.

## **Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Abbot, '89, 1203.

# **BROAD CREEK, DEL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 84.)

## **Appropriations.**

1880-'87 .....	\$20,000
1888 .....	5,000, '88, 750.
1892 .....	5,000

Total .....	30,000
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List of appropriations, '88, 750.

## **Commerce.**

Beneficial effects of improvement, '91, 1210.

## **Contracts.**

1889. F. C. Somers, for dredging, at 20 cents per cubic yard, '89, 894.

## **Engineers.**

### **CHIEF OF ENGINEERS.**

Reports, '88, 94; '89, 107; '90, 98; '91, 131.

### **ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885-'— Reports, '88, 750; '89, 894; '90, 933; '91, 1209.

### **ASSISTANT.**

A. Stierle. Report, '91, 1209.

## **Operations.**

1887-'89. No operations, '88, 750; '89, 894.

1889-'90. 19,987 cubic yards material dredged, '90, 933.

## **Projects.**

By Lieut. Col. Craighill, 1880, for the formation of a channel 60 feet wide and 7 feet deep by dredging from the mouth to Laurel, supplemented by wing dams and training walls; estimated cost, \$60,000, '80, 641.

In 1883 Col. Craighill considered, after an aggregate appropriation of \$20,000, that further dredging without training works would be useless, and estimated that \$32,625 would be required for the completion of the project involving such works, '83, 681.

In 1891 Mr. W. F. Smith proposed the excavation of the present channel between Laurel and Bethel, Del., to a width of 70 feet and a depth of 8 feet at mean low water, at an estimated cost of \$15,000, '91, 1210.

## **Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Mr. W. F. Smith, '91, 1209.

## **MAPS.**

'91, 1210.

# **BROAD CREEK, MD.—EXAMINATION OF.**

## **Engineers.**

### **CHIEF OF ENGINEERS.**

Report, '91, 132.

### **ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent. Report, '91, 1221, 1223.

### **ASSISTANT.**

A. Stierle. Report, '91, 1222, 1224.

## **Physical Characteristics.**

Description of the locality, '91, 1222.

**BROAD CREEK, MD.—Continued.****Plans.**

By Mr. W. F. Smith, 1891, for improvement of the creek by excavation of a 7-foot low-water channel 120 feet in width, from the 7-foot depth in Pocomoke Sound to the same depth in Little Annemessex River, involving the removal of 270,000 cubic yards of material at an estimated cost of \$54,000, '91, 1223.

**Surveys.**

Ordered by act of September 19, 1890. Made, 1891, under direction of Mr. W. F. Smith, '91, 1223.

**BROADKILN RIVER, DEL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 85.)

**Appropriations.**

1873-'82 .....	\$25, 000
1888.....	10, 000, '88, 744.

Total .....	35, 000
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List of appropriations, '88, 744; '91, 1168.

**Contracts.**

1889. American Dredging Company, for dredging, at 7 cents per cubic yard, '90, 929.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 90; '89, 105; '90, 96; '91, 122; '92, 123.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885-'— Reports, '88, 744; '89, 890; '90, 928; '91, 1167; '92, 955.

**Operations.**

1887-'89. No operations, '88, 744; '89, 891.

1889-'90. 20,972 cubic yards material dredged, '90, 928.

1890-'91. 104,284 cubic yards material dredged, '91, 1167.

1891-'92. No operations, '92, 955.

**Projects.**

By Col. Macomb, 1881, for the formation of a river entrance below junction of Lewis and Broadkiln creeks, so as to obtain, by dredging and construction of a deflecting jetty, a channel 6 feet deep at mean low water; estimated cost, \$51,500, '81, 782; '91, 1167; '92, 955.

**BRONX RIVER, N. Y.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 94.

**ENGINEER IN CHARGE.**

Lieut. Col. G. L. Gillespie. Report, '91, 949, 951.

**ASSISTANT.**

G. W. Kuhule. Report, '91, 953.

**Physical Characteristics.**

Description of the river, '91, 949.

**Plans.**

By Lieut. Col. Gillespie, 1890, for improvement of the river by widening and deepening the existing channel so as to afford a navigable channel 4 feet deep at mean low water and 100 feet wide from the head of the estuary at Strain Place to Barlow street, 60 feet wide to Dongan street, and 50 feet wide to West Farms, below the Bronx Company's Dye Works. Total length of channel 1½ miles, involving the removal of 54,880 cubic yards of material at an estimated cost of \$85,985, '91, 952.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Gillespie, '91, 951.

**BROWNS CREEK, SAYVILLE, N. Y.—IMPROVEMENT OF.****Appropriations.**

1890..... \$12,000, '91, 830.  
 1892..... 5,000, '92, 729.

Total ..... 17,000

**Commerce.**

Present and prospective commerce of the locality, '90, 670.

**Contracts.**

E. Bailey & Sons, for riprap jetty construction, at \$2.80 per ton, '91, 830.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 71; '90, 63; '91, 79; '92, 83.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1888-'— . Reports, '90, 669; '91, 828; '92, 727.

**ASSISTANT.**

Lieut. J. C. Sanford. Report, '90, 669.

**Operations.**

1890-'91. No operations, '91, 828.

1891-'92. 492 linear feet of west jetty and 275 linear feet of east jetty completed, '92, 728.

**Physical Characteristics.**

Description of the locality, '90, 669.

**Projects.**

By Col. Houston, 1889, for excavation of a channel 100 feet wide and 6 feet deep at mean low water from the 6-foot curve in the bay up to the first bend in the creek, a distance of 1,850 feet, at an estimated cost of \$46,000, '90, 673; '92, 728.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Col. Houston, '90, 673.

**BRUNSWICK HARBOR, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 87.)

**Appropriations.**

1836-'87 ..... \$102,500  
 1888..... 35,000, '88, 1047.  
 1890..... 35,000, '90, 1407.  
 1892..... 27,500, '92, 1282.

Total ..... 200,000

List of appropriations, '88, 1046; '91, 1553.

**Commerce.**

Increase in business from 1880 to 1890, '90, 1406.

**Contracts.**

1888. P. S. Ross, for dredging, at 21 cents per cubic yard, '89, 1267.

1889. C. C. Ely, for training-wall construction, at \$13,215, '89, 1267.

1891. J. F. Gaynor, for training-wall construction, at a total of \$21,270, '91, 1554.

P. S. Ross, for dredging, at 24½ cents per cubic yard, '91, 1564.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 142; '89, 162, 367; '90, 146; '91, 182, 185; '92, 179.

**BOARD OF ENGINEERS.**

Convened at Savannah, Ga., April 1, 1889, by S. O. No. 30, to establish harbor lines in Brunswick Harbor. Report, '89, 1293. (Capt. Bixby and Lieut. Carter.)

**ENGINEER IN CHARGE.**

Lieut. O. M. Carter, 1886-'—. Reports, '88, 1044; '89, 1263, 1292; '90, 1404; '91, 1550; '92, 1278.

**ASSISTANT.**

M. P. Paret. Report, '89, 1267.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1046.

1888-'89. 50,796 cubic yards material dredged; 2,319 cubic yards of fascines and 369 cubic yards of stone placed in training wall, '89, 1265.

1889-'90. 29,096 cubic yards material dredged; 3,714 cubic yards brush fascines and 619 cubic yards stone placed in training wall, '90, 1406.

1890-'91. 1,220 linear feet of jetty built, '91, 1552.

1891-'92. 49,324 cubic yards material dredged, '92, 1280.

**BRUNSWICK HARBOR, GA.—Continued.****Projects.**

The project for the improvement of Brunswick Harbor, as proposed by Col. Gillmore in 1880, and modified by him in 1886, had as its object the establishment and maintenance of a 15-foot low-water channel across the shoal in East River. The main features of the project were (1) a training wall projecting from the most easterly point of Buzzards Island to the opposite shore of Blythe Island; (2) a low dam across Turtle River; (3) short spur dams in the lower part of East River; (4) dredging in the vicinity of Truth River Dam, and on the shoal in the lower part of East River. The cost of the original project was estimated at \$73,187, and as modified at \$190,000, '90, 1404; '91, 1551; '92, 1279.

**Surveys.**

Made, 1890, under direction of Lieut. Carter, '90, 1407.

**MAPS.**

'88, 1046; '89, 1266; '92, Atlas, 58.

**BUCKHANNON RIVER, W. VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 88.)

**Appropriations.**

1884-'87 .....	\$3,000
1888 .....	1,500, '88, 1795.
1890 .....	1,000, '90, 2280.

Total ..... 5,500

List of appropriations, '92, 2119.

**Commerce.**

Increase in lumber output due to improvement, '88, 1794.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 229; '89, 266; '90, 240; '91, 309; '92, 295.

**ENGINEER IN CHARGE.**

Maj. D. W. Lockwood, 1888—'. Reports, '88, 1794; '89, 1989; '90, 2279; '91, 2474; '92, 2119.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1794.

1888-'89. 3,000 cubic yards of rock removed from the channel, '89, 1989.

1889-'90. 1,106 cubic yards rock and 5 log jams removed from the channel, '90, 2280.

1890-'91. No operations, '91, 2474.

1891-'92. 3,510 cubic yards stone and 160 snags and logs removed from the channel, '92, 2119.

**Projects.**

The project of 1884 contemplates the formation of a rafting channel from the Three Forks to the town of Buckhannon, a distance of 24½ miles, with a width of 30 feet and a depth of 2 feet during four months of each year, '85, 291. After an expenditure of \$4,500, it was estimated, in 1888, that \$20,955 was necessary for completion, '88, 1795.

**BUFFALO HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 90.)

**Appropriations.**

1828-'87 .....	\$1,927,995.37
1888 .....	225,000.00, '88, 2054.
1890 .....	300,000.00, '90, 2836.
1892 .....	300,000.00, '92, 2531.

Total ..... 2,752,995.37

**Commerce.**

Commerce of Buffalo, '89, 2383.

Amount of grain (flour included) delivered in New York City by various routes during the year ending December 31, 1890, '91, 2888.



**BUFFALO HARBOR, N. Y.—Continued.****Contracts.**

1888. Williams & McConnell, for broken stone, at \$1.84 per cubic yard; H. Fleming, for Portland cement, at \$2.09 per barrel; F. O. Norton, for natural cement, at \$1.20 per barrel, '88, 2034.
1889. Union Akron Cement Co., for Portland cement, at \$2.45 per barrel; Fox & Holloway, for sand, at 80 cents per cubic yard; D. McNaughton, for iron moorings at a total of \$1,852; J. M. McCarthy, for recovering concrete blocks washed off the breakwater, at \$2 per block; J. Longprey & Co., for furnishing and driving pine piles, at \$8 per pile, '89, 2386.
1890. W. E. Carroll, for pebbles, at \$1.40 per cubic yard, '90, 2837. J. H. Ross, for Portland cement, at \$2.45 per barrel; Ira Farnsworth, for broken stone, at \$2 per cubic yard; Fox & Holloway, for sand, at 70 cents per cubic yard, '90, 2837.
1891. J. Donnelly, for breakwater extension, at a total of \$66,271.16, '91, 2884. Emil Thiele, for Portland cement, at \$2.58 per barrel, '91, 2885. D. McNaughton, for iron moorings, at \$65 per mooring, '91, 2886. J. B. Donnelly, for rubble stone, at \$1.16 per cubic yard, '91, 2886. P. G. Straub, for broken stone, at \$1.47 per cubic yard, '91, 2886. Fox & Holloway, for sand, at 90 cents per cubic yard, '91, 2886. J. MacGregor, for pebbles, at \$1.75 per cubic yard, '91, 2886.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 279; '89, 330; '90, 299; '91, 375; '92, 354.

**BOARD OF ENGINEERS.**

Convened at Buffalo, N. Y., December 21, 1888, by S. O. No. 69, to report upon the construction of a plant for building the superstructure of the Buffalo Breakwater. First report, '89, 2388. (Lieut. Col. King, Maj. Overman, and Capt. McC. Derby.)

Convened at Buffalo, N. Y., March 6, 1889, to examine and report upon plant for construction of new breakwater superstructure. Second report, '89, 2391. (Lieut. Col. King, Maj. Overman, and Capt. Mahan.)

**ENGINEERS IN CHARGE.**

Capt. F. A. Mahan, 1886-'90. Reports, '88, 2028; '89, 2361.

Maj. A. Stickney, 1890-'92. Reports, '90, 2808; '91, 2882.

Maj. E. H. Ruffner, 1892-'— Report, '92, 2529.

**Operations.**

1887-'88. Repairs to south pier by hired labor; 750 linear feet of breakwater parapet rebuilt with concrete and masonry superstructure; repairs to breakwater and boathouse, '88, 2034, 2046.

1888-'89. South pier repaired by hired labor; breakwater reconstruction continued, and manufacture of concrete blocks begun by hired labor; minor repairs to the breakwater, '89, 2363, 2372.

1889-'90. Work continued on reconstruction of breakwater superstructure, '90, 2832.

1890-'91. 950 concrete blocks manufactured, entire breakwater superstructure removed, and 800 concrete blocks placed in position in reconstruction of the same, '91, 2883.

1891-'92. 362 concrete blocks washed from the breakwater recovered and replaced; reconstruction of breakwater continued, '92, 2530.

**Projects.**

For detailed history of projects see '88, 2028.

The scheme of improvement, as modified at various times, provides for two piers at the entrance to Buffalo Creek; for a masonry sea wall running southwardly from the south pier; for a breakwater about one-half mile from and parallel with the shoal, and for a shore arm to the breakwater from its southerly end, Vol. i, p. 104; '87, 305, 2351, 2366.

In 1886 a masonry and concrete superstructure was adopted for the breakwater, '87, 2353, 2365.

From 1826 to 1886, inclusive, \$1,966,480.41 was appropriated. Amount estimated for completion of existing project, \$1,117,500, '87, 2357; '91, 2882.

**Surveys.****MAPS.**

'88, 2054; '89, 2370.

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**BURLINGTON HARBOR, IOWA.—(See MISSISSIPPI RIVER, FROM SAINT PAUL TO DES MOINES RAPIDS.)**

**BURLINGTON HARBOR, VT.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 81.)

**Appropriations.**

1886-'87 .....	\$526,922.20
1888 .....	35,000.00, '88, 2099.
1890 .....	20,000.00, '90, 2880.
Total .....	581,922.20

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 288; '89, 341; '90, 308; '91, 386; '92, 364.

**ENGINEER, IN CHARGE.**

Maj. M. B. Adams, 1885-'— Reports, '88, 2098; '89, 2448; '90, 2879; '91, 2933; '92, 2609.

**Operations.**

1887-'88. 4,209 cubic yards rubble stone placed in breakwater foundation, '88, 2099.

1888-'89. 780 cubic yards rubble stone placed in breakwater foundation, '89, 2449.

1889-'90. No operations, '90, 2880.

1890-'91. Repairs to breakwater, '91, 2934.

1891-'92. Repairs to 1,000 linear feet of superstructure, '92, 2611.

**Projects.**

Between 1836 and 1857, 1,069 linear feet of breakwater had been built. In 1867 a Board of Engineers recommended a further extension northward of 1,500 linear feet. In 1871, 831 linear feet of this extension had been made.

Between 1871 and 1874, 617 linear feet were added in a southward extension, making a total extension of 2,517 linear feet, '74, i, 274.

In 1874 an additional extension of 2,000 linear feet was adopted, at an estimated cost of \$340,000, '74, 275.

In 1884, under an appropriation of \$25,000, extensive repairs were undertaken over the part of the breakwater built between 1836 and 1857. In 1886 Maj. Adams proposed a further extension of the breakwater, both to the north and south, with the gradual withdrawal of the work as prolonged into water 32 feet deep, '87, 315, 2406.

From 1836 to 1886, inclusive, \$526,922.20 was appropriated. In 1887 the cost of the completion of the project was estimated at \$184,250, '87, 2409.

**BUTTERMILK CHANNEL, NEW YORK HARBOR.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 93.)

**Appropriations.**

1880-'87 .....	\$246,250
1888 .....	100,000, '88, 612.
1892 .....	100,000, '92, 816.
Total .....	446,250

List of appropriations, '88, 612; '91, 913.

**Contracts.**

1889. J. A. Simmons, for dredging, at 18½ cents per cubic yard, '89, 782.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 61; '89, 78; '90, 69; '91, 88, 93; '92, 92.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. McFarland, 1884-'89. Report, '88, 610.

Lieut. Col. G. L. Gillespie, 1889-'— Reports, '89, 780; '90, 724; '91, 911, 937; '92, 814.

**Operations.**

1887-'89. No operations, '88, 612; '89, 782.

1889-'90. 206,199 cubic yards material dredged, '90, 726.

1890-'91. 190,000 cubic yards material dredged, '91, 913.

1891-'92. Channel completed through shoal at southern entrance, '92, 815.

**Physical Characteristics.**

Description of the channel, '88, 610.

**BUTTERMILK CHANNEL, NEW YORK HARBOR—Continued.****Plans.**

In 1890 Lieut. Col. Gillespie did not consider Buttermilk and Gowanus Bay channels worthy of improvement to the extent of securing a 26-foot depth, '91, 938.

**Projects.**

By Col. Newton, in 1880, for the removal of the shoal between Long Island and Governors Island to a depth of 26 feet and to a width of 850 feet from the Brooklyn wharves; estimated cost, \$210,000, '80, 506; '81, 629; '86, 721. In 1887, after an aggregate appropriation of \$190,000, Lieut. Col. McFarland estimated that \$95,000 would be required to complete the project, '87, 705.

**CACHE RIVER, ARK.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 94.)

**Appropriations.**

1888 .....	\$7,000, '89, 1659.
1892 .....	2,000, '92, 1687.

Total .....	9,000
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**Commerce.**

Great prospective advantages to commerce to result from opening the river, '91, 2052.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 189; '89, 222; '90, 200; '91, 253; '92, 244.

**ENGINEER IN CHARGE.**

Capt. H. S. Taber, 1887-'— Reports, '89, 1659; '90, 1946; '91, 2051; '92, 1687.

**Operations.**

1887-'88. No operations, '88, 189.

1888-'89. Snag boat *Riverside* built; 67 snags, 14 drift piles, and 69 overhanging trees removed, '89, 1659.

1889-'90. 341 snags, 158 trees, and 20 drift piles removed, '90, 1947.

1890-'92. No operations, '91, 2052; '92, 1687.

**Projects.**

By Capt. Taber, 1887, for the removal of snags between the mouth and Riverside; estimated cost, \$7,000, '87, 1548; increased to \$10,000 in 1891, '91, 2053.

**CAHABA RIVER, ALA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 94.)

**Appropriations.**

1882-'87 .....	\$37,500
1892 .....	7,500, '92, 1434.

Total .....	45,000
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List of appropriations, '88, 1186.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 157; '89, 183; '90, 165; '91, 210; '92, 204.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1185.

Capt. P. M. Price, 1889-'—. Reports, '89, 1398; '90, 1651; '91, 1751; '92, 1432.

**ASSISTANTS.**

Lieut. C. L. Potter. Report, '90, 1653.

C. B. Percy. Reports, '91, 1755; '92, 1433.

**Obstructions.**

Bridges obstructing navigation upon the Cahaba, '88, 1186; '90, 1653.

**Operations.**

1887-'90. No operations on account of obstruction of the river by bridges without draw openings, '88, 1186; '89, 1399.

**CAHABA RIVER, ALA.—Continued.****Operations—Continued.**

1890-'91. The act of September 19, 1890, having removed the restriction upon the expenditure of available funds, the construction of a light-draft log boat was begun, '91, 1755.

1891-'92. 1,613 snags and logs removed from the channel; 277 cubic yards gravel excavated; 1,550 linear feet of willow jetty constructed, '92, 1433.

**Physical Characteristics.**

Character and slope of river bed, '88, 1186.

**Projects.**

By Maj. Damrell, 1883, to obtain for the Lower Cahaba River a navigable channel from its mouth to the town of Centerville, a distance of 88 miles, giving a depth of 3 feet at low water and a width in open river of 100 feet, and in soft rock and bar cuts 60 feet; this to be accomplished by removal of snags, dredging through soft rock and gravel bars, and by contracting and regulating the channel; estimated cost, \$195,000, '83, 996; '86, 202; '87, 1287; '92, 1432.

**CALAIS, ME.—(See SAINT CROIX RIVER.)****CALCASIEU RIVER AND PASS, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 95.)

**Appropriations.**

1872-'87 .....	\$46,500
1888.....	10,000, '88, 1257.
1890.....	75,000, '90, 1751.
1892.....	100,000, '92, 1506.

Total ..... 231,500

List of appropriations, '92, 1505.

**Commerce.**

Extent to which further improvement would benefit commerce, '89, 1528.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 171; '89, 199, 202; '90, 180; '91, 226; '92, 220.

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1256; '89, 1492, 1527; '90, 1750.

Maj. J. B. Quinn, 1890-'—. Reports, '91, 1829; '92, 1504.

**Operations.**

1887-'88. 50,085 cubic yards material dredged by hired labor from bar at mouth of Calcasieu River, '88, 1257.

1888-'89. 27,074 cubic yards material dredged by hired labor, '89, 1493.

1889-'92. No operations, '90, 1750; '91, 1830; '92, 1505.

**Projects.**

The project of 1871 proposed improving the bar at the head of the Pass by dredging a channel 80 feet wide,  $1\frac{1}{4}$  miles long, and 5 feet deep, at an estimated cost of \$15,000, '71, 558; '72, 62; '82, 1387; '86, 1277.

This work was accomplished in 1873-'74, '74, i, 73, 721.

By Maj. Howell, 1881, for improvement of Calcasieu River above the town of Lake Charles to Phillips Bluff by cleaning channel of snags, logs, etc., to a navigable width and depth, and dredging bar at foot of Calcasieu Lake, at an estimated cost of \$25,080, '81, 196, 1302.

In 1881, the previously dredged channel having closed, it was proposed to reopen it by the formation of a channel 70 feet wide and 8 feet deep at low water; estimated cost, \$15,000, '81, 1304; '86, 1277.

In 1886, the channel having again partially refilled, it was proposed to re-form a dredged channel 100 feet wide and 6 feet deep, protected by a pile and plank revetment on each side, '87, 1373.

By Maj. Heuer, 1887, to obtain a 12-foot depth through the bar which obstructs the passage from the Pass to the deep water of the Gulf, by the construction of two converging jetties of brush mattress and riprap granite, at an estimated cost of \$600,000, '87, 1403, 1404.

**Surveys.**

Examination ordered by act of August 5, 1886. Made, 1888, under direction of Capt. Fisk, '89, 1527.

**CALOOSAHATCHIE RIVER, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 96.)

**Appropriations.**

1882-'87 .....	\$14,000
1888 .....	10,000, '88, 1095.
1890 .....	3,600, '90, 1599.
1892 .....	1,000, '92, 1378.

Total .....	28,600
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 146; '89, 169; '90, 151; '91, 189; '92, 187.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1886-'92. Reports, '88, 1093; '89, 1337; '90, 1596; '91, 1643.

Maj. J. C. Mallery, 1892-'— Report, '92, 1377.

**ASSISTANT.**

J. W. Sackett. Report, '88, 1095.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1094.

1888-'89. No operations, '89, 1338.

1889-'90. 1,391 snags and 200 cubic yards sand removed from the channel, and 584 overhanging trees from the banks; 1,300 piles sunk, 1,157 linear feet of waling and 242 cubic yards brush protection placed, '90, 1598.

1890-'91. 9,044 cubic yards sand and 330 snags cleared from the channel, and 1,800 trees cut from the banks; 18 cubic yards rock blasted and 615 linear feet of training wall built, '91, 1645.

1891-'92. No operations, '92, 1378.

**Physical Characteristics.**

Description of river, '88, 1093; '91, 1643.

**Projects.**

By Capt. Damrell, 1879, for the formation of a channel 100 feet wide and 7 feet deep by dredging and removal of snags from the river's mouth to Fort Myers, a distance of 14 miles; estimated cost, \$20,000, '79, 864, 869; '83, 1003; '85, 1273. This project was completed in 1886, at a cost of \$14,000, '87, 1236.

By Capt. Black, 1887, for improvement of the river between Forts Myers and Thompson for vessels drawing 4 feet, by clearing the river of obstructions and straightening and deepening the channel at Beautiful Plains; estimated cost, \$13,647, '87, 1236; '89, 1338.

Project for improvement completed in 1892. Annual expenditure required for maintenance, \$1,000, '92, 1378.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Capt. Black, '88, 1095.

**MAPS.**

'89, 1338; '90, 1598.

**CALUMET HARBOR, ILL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 97.)

**Appropriations.**

1870-'87 .....	\$392,000
1888 .....	20,400, '88, 1889.
1890 .....	20,000, '90, 2405.
1892 .....	15,000, '92, 2246.

Total .....	447,400
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**Commerce.**

Increase in manufacturing interests and tonnage consequent upon improvement, '90, 2404.

**Contracts.**

1888. H. B. Herr &amp; Co., for pier extension, at a total of \$8,954.70, '89, 2118.

1890. W. A. McGillis &amp; Co., for dredging, at 13½ cents per cubic yard, '91, 2603.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 248; '89, 288; '90, 260; '91, 330; '92, 316.

**ENGINEER IN CHARGE.**

Capt. W. S. Marshall, 1888-'—. Reports, '88, 1888; '89, 2116; '90, 2404; '91, 2602; '92, 2245.

**CALUMET HARBOR, ILL.—Continued.****Engineers—Continued.****ASSISTANT.**

G. A. M. Liljencrantz. Reports, '89, 2118; '90, 2405; '91, 2604; '92, 2247.

**Operations.**

1887-'88. No operations, '88, 1889.

1888-'89. North pier completed to a length of 3,640 feet; south pier to a length of 2,020 feet, '89, 2117.

1889-'90. No operations, '90, 2404.

1890-'91. 29,088 cubic yards material dredged, '91, 2602.

1891-'92. 57,930 cubic yards material dredged, '92, 2246.

**Projects.**

By Maj. Wheeler, in 1870, for the formation of a harbor by the extension of two parallel piers 300 feet apart and extended to at least the 12-foot curve; estimated cost, \$300,000, '70, 104, 107; '71, 117; '76, ii, 441, 442. Modified subsequently to provide a channel of entrance 16 feet deep and 30 feet wide, '80, 211, 1988; '86, 306.

By Board of Engineers, 1882, for the formation of a dredged channel in Calumet River, 200 feet wide and 16 feet deep, from Lake Michigan to the fork at Calumet Lake; estimated cost, \$225,000, '83, 1750. (Lieut. Col. Houston and Maj. Smith and Benyanrd.) Approved by the Chief of Engineers, '83, 1748. In 1886, \$392,000 having been appropriated, \$11,400 is estimated for completion of existing project, '86, 307.

In 1888 Capt. Marshall estimated for the completion of the channel 16 feet deep and 300 feet wide between the piers, and the reconstruction of north and south pier superstructures, at a total of \$43,500, '88, 1889. Increased in 1889 to \$47,000, '89, 2117; and in 1890 to \$67,000, '90, 2406.

**Surveys.****MAPS.**

'89, 2116; '90, 2404; '91, 2605; '92, Atlas, 105, 106.

**CALUMET RIVER, ILL. AND IND.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 93.)

**Appropriations.**

1884-'87 .....	\$80,000
1888 .....	50,000, '88, 1896.
1890 .....	50,000, '90, 2578.
1892 .....	75,000, '92, 2252.

Total ..... 255,000

**Contracts.**

1887. S. O. Dixon, for dredging, at 11 cents per cubic yard, '88, 1898.

1888. W. A. McGillis & Co., for dredging, at 11½ cents per cubic yard, '89, 2143.

1889. Burdick & McMahon, for dredging, at 22 cents per cubic yard, '89, 2143.

1890. Wheeler & Russell, for dredging, at 12½ cents per cubic yard, '91, 2607.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 250; '89, 290; '90, 262; '91, 331; '92, 317.

**ENGINEER IN CHARGE.**

Capt. W. L. Marshall, 1888-'—. Reports, '88, 1896; '89, 2142; '90, 2576; '91, 2606; '92, 2249.

**ASSISTANT.**

G. A. M. Liljencrantz. Reports, '89, 2145; '90, 2578; '91, 2609; '92, 2252.

**Operations.**

1887-'88. 76,800 cubic yards material dredged, '88, 1897.

1888-'89. 34,523 cubic yards material dredged, '89, 2576.

1889-'90. 354,017 cubic yards material dredged, '90, 2576.

1890-'91. 72,111 cubic yards material dredged, '91, 2607.

1891-'92. 293,608 cubic yards material dredged, '92, 2249.

**Projects.**

By Board of Engineers, 1882, for improvement of the lower section of Calumet River from Lake Michigan to the Forks, a distance of 6½ miles, by dredging channel 200 feet wide and 16 feet deep; estimated cost, \$225,000, '83, 1748, 1749, 1750; '86, 308.

In 1885 Maj. Benyanrd proposed the extension of the improved channel from the Forks to a point half a mile east of Hammond, at an additional cost of \$200,000, '85, 2061; making the entire estimated cost of the project \$425,000, '87, 2167, 2170.

**CALUMET RIVER, ILL. AND IND.—Continued.\*****Projects—Continued.**

By Capt. Marshall, 1889, for dredging the Calumet River to secure a channel from its mouth to one-half mile east of Hammond, 16 feet deep and 200 feet wide throughout; estimated total cost, \$1,000,000, or \$870,000 for completion, '89, 2144; '91, 2608.

**Surveys.**

Survey made, 1889, under direction of Capt. Marshall, '89, 2147.

**MAPS.**

'89, 2142; '90, 2578; '91, 2610; '92, Atlas, 107, 108.

**CAMBRIDGE HARBOR, MD.—IMPROVEMENT OF.**

(See CHOPTANK CREEK, MD.)

(Continued from Vol. II, p. 99.)

**Appropriations.**

1871-'79 .....	\$32,500
1888 .....	5,000, '88, 93.
1890 .....	5,000, '90, 940.
1892 .....	7,737, '92, 974.

Total ..... 50,237

List of appropriations, '89, 903; '91, 1193.

**Contracts.**

1889. C. T. Caler, for dredging, at 18½ cents per cubic yard, '89, 904.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 93; '89, 110; '90, 101; '91, 127; '92, 127.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885-'— Reports, '89, 902; '90, 940; '91, 1191; '92, 973.

**Operations.**

1887-'88. No operations, '88, 93.

1888-'89. 23,000 cubic yards material dredged, '89, 902.

1889-'92. No operations, '90, 940; '91, 1192; '92, 974.

**Projects.**

By Lieut. Col. Craighill, 1871, for the formation, by dredging, of a channel of entrance to Choptank Creek and a basin 8 feet deep abreast of Cambridge, '74, ii, 24. Modified in 1874 for enlargement of basin and channel leading thereto, '79, 501. Amount appropriated from 1871 to 1879, inclusive, \$32,500, '87, 852.

In 1890, after an expenditure of \$42,500, \$7,736 was estimated as required for completion of existing project, '90, 940, 941; '91, 1193.

**CAMDEN HARBOR, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 100.)

**Appropriations.**

1873-'87 .....	\$30,000
1888 .....	5,000, '89, 523.
1890 .....	6,000, '90, 436.
1892 .....	12,000, '92, 510.

Total ..... 53,000

List of appropriations, '92, 509.

**Commerce.**

Shipbuilding and manufacturing interests, '88, 403, 404.

**Contracts.**

1889. E. P. Lovering, for dredging, at 25 cents per cubic yard, '89, 524.

**CAMDEN HARBOR, ME.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 14, 22; '89, 23; '90, 19; '91, 24; '92, 28.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1888-'92. Reports, '88, 403; '89, 523; '90, 436; '91, 587.

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 509.

**ASSISTANT.**

F. S. Burrowes. Report, '88, 406.

**Operations.**

1887-'89. No operations, '88, 403; '89, 523.

1889-'90. 18,045 cubic yards material dredged, '90, 436.

1890-'91. No operations, '91, 587.

1891-'92. 30,664 cubic yards material dredged, '92, 510.

**Projects.**

By Lieut. Col. Smith, 1888, for improvement of channel and harbor areas by deepening two areas to 10 and 12 feet mean low water, respectively, and the excavation of Channel C 100 feet wide, and Channel D 50 feet wide, both to be 10 feet in depth; estimated cost, \$59,930, '88, 405, 406; increased in 1890 to \$60,000, '90, 436; '91, 588; '92, 509.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Lieut. Col. Smith, '88, 405.

**CANAL AT THE CASCADES, COLUMBIA RIVER, OREG.—(See COLUMBIA RIVER, AT THE CASCADES.)****CANAL AT DES MOINES RAPIDS, MISSISSIPPI RIVER.—(See DES MOINES RAPIDS CANAL.)****CANALWAY CONNECTING LAKE MICHIGAN WITH THE CALUMET RIVER.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 293.

**ENGINEER IN CHARGE.**

Capt. W. L. Marshall, 1888. Report, '89, 2154.

**ASSISTANT.**

G. A. M. Liljencrantz. Report, '89, 2156.

**Physical Characteristics.**

Description of the locality, '89, 2156.

**Plans.**

In 1889 Capt. Marshall did not consider the locality worthy of improvement, '89, 2155.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Marshall, '89, 2154.

**CANAL AT LOUISVILLE, OHIO RIVER.—(See LOUISVILLE AND PORTLAND CANAL.)****CANAL AT MUSCLE SHOALS, TENN.—(See TENNESSEE RIVER.)****CANAL AT SAINT CLAIR FLATS, MICH.—(See SAINT CLAIR FLATS CANAL.)**



**CANAL AT SAINT MARYS FALLS, MICH.**—(See SAINT MARYS FALLS CANAL.)

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**CANAL AROUND SMITHS SHOALS, CUMBERLAND RIVER.**—  
(See CUMBERLAND RIVER.)

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**CANAPITSIT CHANNEL, MASS.**—SURVEY OF.

**Appropriations.**

1892..... \$4, 800

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 62; '92, 66.

ENGINEERS IN CHARGE.

Capt. W. H. Bixby, 1892-'— Report, '92, 645.

Maj. W. R. Livermore, 1892-'— Report, '92, 645.

**Plans.**

By Maj. Livermore, 1891, for improvement of Canapitsit Channel, between Cuttybunk and Nashawena Islands, by removal of bowlders and dredging to a depth of 6 feet at mean low tide; estimated cost, \$4,800, '92, 647.

**Surveys.**

Survey of the channel, between Cuttybunk and Nashawena Islands. Made, 1891, under direction of Maj. Livermore, '92, 646.

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**CANARSIE BAY, N. Y.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 102.)

**Appropriations.**

1880-'87 .....	\$33, 000
1888 .....	10, 000, '88, 628.
1890 .....	5, 000, '90, 841.
1892 .....	5, 000, '92, 867.

Total ..... 53, 000

List of appropriations, '88, 628.

**Commerce.**

Fishing industry of the bay, '88, 628.

**Contracts.**

1888. S. A. Kelly, for pile dike construction, at \$9.87 per linear foot, '88, 629.

1891. E. Brainard, for dredging, at 24 cents per cubic yard, '91, 980.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 65; '89, 84; '90, 75; '91, 95; '92, 98.

ENGINEERS IN CHARGE.

Lieut. Col. W. M. McFarland, 1886-'89. Report, '88, 627.

Capt. T. L. Casey, 1889-'— Reports, '89, 816; '90, 839; '91, 980; '92, 866.

**Operations.**

1887-'88. 2,946 cubic yards material dredged, 590 linear feet of piling driven, and 30 feet of dike timbered and prepared for stone filling, '88, 626.

1888-'89. 33,320 cubic yards material dredged; 820 feet of dike built, '89, 817.

1889-'90. No operations, '90, 840; '91, 981.

1891-'92. 12,760 cubic yards material dredged; repairs to north dike, '92, 866.

**Physical Characteristics.**

Description of the harbor, '88, 627.

**Projects.**

By Col. Newton, 1879, to afford a channel of entrance into Canarsie Bay, of navigable width and not less than 6 feet depth, through the aid of dikes inclosing a tidal basin; estimated cost, \$88,000, '79, 400; '80, 84; '82, 670; '91, 981; '92, 866.

**CANEY CREEK, TEX.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 207.

ENGINEER IN CHARGE.

Maj. O. H. Ernst, 1888. Report, '89, 1580.

ASSISTANT.

R. B. Talfor. Report, '89, 1581.

**Plans.**

In 1889, in view of the considerable cost of an improvement, its want of permanence, and the small amount of commerce, present or prospective, to be benefited thereby, Maj. Ernst did not consider the creek worthy of improvement, '89, 1581.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Ernst, '89, 1580.

**CANEY FORK RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 104.)

**Appropriations.**

1880-'87 .....	\$20,000
1888 .....	2,500, '88, 1634.
1890 .....	2,500, '90, 2150.

Total .....	25,000
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List of appropriations, '89, 1847; '91, 2284.

**Commerce.**

Commerce of the river, '88, 1635.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 212; '89, 247; '90, 223; '91, 284; '92, 272.

ENGINEERS IN CHARGE.

Lient. Col. J. W. Barlow, 1886-'92. Reports, '88, 1634; '89, 1847; '90, 2149; '91, 2284.

Lient. Col. H. M. Robert, 1892-'—. Report, '92, 1941.

**Operations.**

1887-'88. 1,550 cubic yards rock, sand, and gravel excavated; 593 cubic yards riprap stone quarried; 568 linear feet of spur riprap dams built; 219 snags removed from the channel, and 4,151 trees from the banks, '88, 1635.

1888-'89. 15 cubic yards rock and 28 snags removed from the channel; 1,316 cubic yards riprap stone quarried, '89, 1848.

1889-'90. 4 snags removed, 65 bowlders and 388 cubic yards stone quarried, and 1,223 cubic yards riprap dam built, '90, 2150.

1890-'91. 4,787 trees cut, and 49 snags and 440 cubic yards rock removed from the channel, '91, 2285.

1891-'92. 30 cubic yards rock, 227 snags, and 5,969 overhanging trees removed from the channel and banks, '92, 1941.

**Projects.**

By Capt. Overman, 1878, for the formation of a navigable channel during five months of the year from the mouth to Slingo by removal of obstructions, dredging and rock removal, and the construction of riprap dams; estimated cost, \$30,228, '79, 1275, 1277; '83, 1500; '87, 1767.

By Lient. Col. Barlow, 1886, for extending navigation from Slingo to Franks Ferry; estimated cost, \$15,000, making the entire estimated cost \$45,000, '87, 1767, 1769; '92, 1941.

**CAPE CHARLES CITY HARBOR, VA.—IMPROVEMENT OF.****Appropriations.**

1890 .....	\$25,000, '91, 1200.
1892 .....	10,000, '92, 979.

Total .....	35,000
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**Contracts.**

1890. American Dredging Company, for dredging, at 18 cents per cubic yard, '91, 1199.

**CAPE CHARLES CITY HARBOR, VA.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 112; '90, 102; '91, 130; '92, 130.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1888-'—. Reports, '90, 971, 973; '91, 1199; '92, 979.

**ASSISTANT.**

A. Stierle. Report, '90, 972.

**Operations.**

1890-'91. 107,079 cubic yards material dredged from the harbor proper, harbor entrance, and Cherrystone Inlet, '91, 1200.

1891-'92. No operations, '92, 979.

**Physical Characteristics.**

Description of the locality, '90, 976; '91, 1199.

**Projects.**

By Mr. W. F. Smith, 1890, for dredging the harbor and the entrance thereto to a depth of 14 feet below mean low tide; also dredging the present channel in Cherrystone Inlet and across Cherrystone Bar to a width of 100 and 200 feet, respectively, and a depth of 16 feet at mean low tide, with construction of stone contractive works at the harbor entrance; estimated cost, \$142,340, '90, 979; '91, 1199.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Mr. W. F. Smith, '90, 975

**CAPE FEAR RIVER, N. C., above Wilmington.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 106.)

**Appropriations.**

1881-'87 .....	\$76, 250
1888 .....	12, 000, '88, 895.
1890 .....	15, 000, '90, 1150.
1892 .....	15, 000, '92, 1161.

Total ..... 118, 250

**Commerce.**

Decrease in freight and insurance rates, '89, 1088.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 124; '89, 143; '90, 129; '91, 165; '92, 165.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 893; '89, 1083; '90, 1148; '91, 1390.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1158.

**ASSISTANTS.**

C. Humphreys. Reports, '89, 1086; '90, 1151; '91, 1393.

E. D. Thompson. Report, '92, 1161.

**Operations.**

1887-'88. 127 logs, stumps, and piles removed from river bed; 900 stumps and trees removed from river bank; 2,385 cubic yards rock quarried, '88, 894.

1888-'89. 2,570 cubic yards stone quarried; 80 logs and trees and 50 linear feet of old pile jetty removed from the channel, and trees and brush from the banks, '89, 1085.

1889-'90. 1,277 cubic yards stone quarried; 184 logs and snags removed from the channel; 620 linear feet jetty (stone and brush) built, '90, 1149.

1890-'91. 1,791 cubic yards of stone quarried and 1,060 cubic yards placed in dikes at McCarters, McRaes, and Thames Shoals; 119 trees and 105 cords brush cleared from the banks, and 126 snags and stumps from the channel, '91, 1391.

1891-'92. 793 linear feet of brush and stone jetty built at McRaes Shoal; 228 snags and trees cleared from the channel, '92, 1160.

**Physical Characteristics.**

Description of the river, '88, 893.

**CAPE FEAR RIVER, N. C., above Wilmington—Continued.****Projects.**

By Capt. Phillips, 1881, for clearing snags, trees, etc., from 75 miles of river; for dredging a channel at Thames Shoal, 1,900 feet long, 60 feet wide, and 5 feet deep at low water, and for construction of 5,000 linear feet of experimental dike; estimated cost, \$55,775, '81, 1018. Modified, 1885, by Capt. Bixby, to secure a 4-foot channel from Wilmington to Elizabethtown; thence a similar 3-foot channel to Fayetteville, at an increased cost of \$200,000, '85, 1084. Modified, 1886, by Capt. Bixby, for removal of snags, logs, and stumps, and construction of 84,000 linear feet rock jetty, at a cost of \$480,000, inclusive of \$65,000 previously appropriated, '86, 996; '87, 1045; '91, 1392.

**Surveys.****MAPS.**

'89, 1086; '90, 1150; '91, 1392.

**CAPE FEAR RIVER, at and below Wilmington, N. C.—**

IMPROVEMENT OF.

(Continued from Vol. II, p. 106.)

**Appropriations.**

1829-'87 .....	\$2, 223, 228.92
1888 .....	245, 000.00, '88, 900.
1890 .....	170, 000.00, '90, 1156.
1892 .....	200, 000.00, '92, 1169.

Total ..... 2, 838, 228.92

**Contracts.**

1888. T. Smith, for steam boiler, at \$3,045, '88, 900.  
1889. Atlas Dredging Company, for dredging, at 12 cents per cubic yard, '89, 1092.  
1890. P. S. Ross, for dredging, at 13½ cents per cubic yard, '91, 1398.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 125; '89, 144, 148; '90, 130; '91, 166; '92, 165.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 895; '89, 1089, 1132; '90, 1152; '91, 1394.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1164.

**ASSISTANTS.**

C. Humphreys. Report, '88, 901.

H. Bacon. Reports, '88, 902; '89, 1093; '90, 1156.

R. C. Merritt. Report, '91, 1398.

E. D. Thompson. Report, '92, 1169.

**Operations.**

1887-'88. 282,068 cubic yards material dredged; 14,551 tons stone placed upon the dike, '88, 898.

1888-'89. 243,826 cubic yards material dredged; top and slopes of new dam for 2,468 feet faced with stone, '89, 1093.

1889-'90. 1,237,936 cubic yards material dredged from channel and shoals, '90, 1155.

1890-'91. 356,224 cubic yards of material dredged, '91, 1397.

1891-'92. 105,563 cubic yards material dredged, '92, 1171.

**Physical Characteristics.**

Description of the river between Wilmington and its mouth, '89, 1132.

**Plans.**

By Capt. Bixby, 1889, for obtaining a 20-foot low-water depth from Wilmington to the mouth, with from 18 to 20 feet on the bar, by dredging and the construction, if necessary, of a stone jetty to prevent swining and shoaling of the channel; estimated cost, \$1,800,000, with annual cost for maintenance of from \$18,000 to \$25,000 annually, '89, 1134.

**Projects.**

History of past projects and operations, '82, 943; '86, 168, 1006; '87, 1047.

The Board of Engineers, 1881, in preliminary report, recommend that existing works between Jekes and Smiths Islands be strengthened, and that upon a threatened break in the low beach south of Smiths Island a mattress and rip-rap sill be placed to prevent such break, '82, 947. (Lieut. Cols. Gillmore, Craig-hill, and Comstock, and Capt. Turtle.)

**CAPE FEAR RIVER, at and below Wilmington, N. C.—Continued.****Projects—Continued.**

The projects of 1872 to 1882 proposed the extension of New Inlet Dam 2 miles down stream, to prevent further erosion of Smiths Island. The project of 1875 proposed occasional dredging in the outer bar; and the projects of 1874 to 1881, for the improvement of the 20 miles above New Inlet, proposed dredging wherever necessary to secure a channel eventually 16 feet at mean low water and 270 feet wide. Amounts appropriated from 1829 to 1886, \$2,223,228.92. Amount estimated to complete projects in 1886, \$245,000, '82, 947; '86, 168, 1006. Increased in 1887 to \$265,000, '87, 1048, 1051, 1058.

The projects of 1874 to 1881, for the 20 miles above New Inlet, as outlined to date, proposed dredging, with occasional diking when necessary, across the shoals, so as to secure, first, a 12-foot channel 200 feet wide, and afterwards a 16-foot channel 270 feet wide at low water, over this entire length. The total final cost of this work under the projects of 1870 to 1885 was estimated, in 1886, at \$2,110,000. On account of inadequate yearly appropriations these estimates were raised in 1888 to \$2,125,000.

**Surveys.**

Examination for a 20-foot channel from Wilmington to the ocean ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1132.

**MAFS.**

Cape Fear River below Wilmington, '88, 900; '89, 1092; '90, 1156; '91, 1938.

**CAPE MAY CITY, N. J.—EXAMINATION FOR BREAKWATER AT.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 118.

ENGINEER IN CHARGE.

Maj. C. W. Raymond. Report, '91, 1099.

**Physical Characteristics.**

Description of the locality, '91, 1099.

**Plans.**

In 1890 Maj. Raymond did not consider the locality worthy of improvement, '91, 1100.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Raymond, '91, 1099.

**CAPE VINCENT HARBOR, N. Y.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 337.

ENGINEER IN CHARGE.

Capt. C. F. Palfrey. Report, '89, 2432.

**Physical Characteristics.**

Description of the locality, '89, 2432.

**Plans.**

In 1889 the Chief of Engineers did not consider the locality worthy of improvement, '89, 337.

**Surveys.**

Examination for a breakwater ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Palfrey, '89, 2432.

**CATAWBA RIVER, N. C.—EXAMINATION OF.**

(Continued from Vol. II, p. 110.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 134.

**CATAWBA RIVER, N. C.—Continued.****Engineers—Continued.****ENGINEER IN CHARGE.**

Capt. W. H. Bixby. Reports, '88, 958, 561, 562.

**ASSISTANT.**

Lient. H. Taylor. Report, '88, 965.

**Physical Characteristics.**

Description of the river, '88, 959, 963, 965.

**Plans.**

Capt. Bixby, 1888, considers that the commerce of the river does not warrant the expense of its improvement, '88, 962.

**Surveys.**

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Bixby, '88, 958.

**CAVE RIVER, LA.—EXAMINATION FOR SLACK-WATER NAVIGATION.**

(Continued from Vol. II, p. 103.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 249, 2022.

**ENGINEER IN CHARGE.**

Capt. J. H. Willard. Report, '91, 2022.

**Plans.**

In 1891 Capt. Willard did not consider the locality worthy of a slack-water improvement, '91, 2027.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Willard, '91, 2022.

**CEDAR KEYS HARBOR, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 112.)

**Appropriations.**

1879-'87 .....	\$94, 500
1888 .....	7, 500, '88, 1118.
1890 .....	2, 500, '90, 1610.

Total..... 104, 500

List of appropriations, '92, 1392.

**Commerce.**

Decline in commercial importance of Cedar Keys, '90, 1610.

**Contracts.**

1889. D. G. Ambler, for dredging, at 29 cents per cubic yard, '89, 1348.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 149; '89, 172; '90, 155; '91, 193; '92, 191.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1886-'92. Reports, '88, 1116; '89, 1347; '90, 1609; '91, 1661.

Maj. J. C. Mallery, 1892-'—. Report, '92, 1392.

**Operations.**

1887-'88. 12,945 cubic yards material dredged, '88, 1117.

1888-'89. No operations, '89, 1348.

1889-'90. 9,180 cubic yards material dredged, '90, 1610.

1890-'91. 19,055 cubic yards material dredged, '91, 1662.

1891-'92. 3,962 cubic yards material dredged, '92, 1392.

**Physical Characteristics.**

Description of the harbor, '89, 1347.

**Projects.**

Between 1872 and 1880 a channel 200 feet wide, 11½ and 12 feet deep, was formed through the middle ground and outer bar, '78, 589; '79, 813; '87, 1251.

By Capt. Damrell, 1884, for widening the channel formed in 1872-'81, through the middle ground, to a width of 200 feet and a depth of 10½ feet, by dredging and rock removal; estimated cost, \$25,000, '85, 196, 1270. Revised in 1887 to \$66,000, on account of increased quantity of rock to be removed, '87, 1252.

**CEDAR KEYS HARBOR, FLA.—Continued.****Projects—Continued.**

In 1891 Capt. Black did not consider further improvement desirable in view of the decreasing commercial importance of the locality, '91, 1662; '92, 1392.

**Surveys.****MAPS.**

'88, 1118.

**CEDAR RIVER HARBOR, MICH.—IMPROVEMENT OF MOUTH OF.**

(Continued from Vol. II, p. 113.)

**Appropriations.**

1882-'84 ..... \$30,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 236; '89, 275; '90, 248; '91, 318; '92, 303.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1835; '89, 2043; '90, 2327; '91, 2525.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2172.

**Operations.**

1887-'90. No operations for lack of funds, '88, 1836; '89, 2043; '90, 2327; '91, 2526; '92, 2172.

**Plans.**

Maj. Davis, 1888, reports the commerce of the locality as small and entirely local. No appropriation since 1881, '88, 1836; '91, 2526.

**Projects.**

By Maj. Robert, 1881, for the construction of two parallel piers, 200 feet apart, extending from the outer ends of existing private piers to about the 16-foot curve in Green Bay; also the dredging of the channel between the piers to the depth of 14 feet; estimated cost, \$138,000, '82, 2121, 2124. Change in direction of piers, '85, 1976; '92, 2172.

**CENTREVILLE CREEK, WIS.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 286.

**ENGINEER IN CHARGE.**

Maj. C. E. L. B. Davis. Report, '89, 2102.

**Plans.**

In 1888 Maj. Davis did not consider that the present or prospective commerce of the creek warranted so large an expenditure as would be required for improvement, '89, 2103.

**CHAGRIN RIVER, near Willoughby, Ohio.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 328.

**ENGINEER IN CHARGE.**

Maj. L. C. Overman. Report, '89, 2337.

**Physical Characteristics.**

Description of the locality, '89, 2337.

**Plans.**

In 1889 Maj. Overman did not consider that the demands of commerce required the construction of a harbor at the mouth of the river, '89, 2337.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Overman, '89, 2336.

**CHAMPLINS CREEK, N. Y.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 943.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie. Report, '91, 943.

**Physical Characteristics.**

Description of the locality, '91, 943.

**Plans.**

In view of there being no commercial interests involved, Lieut. Col. Gillespie, in 1890, did not consider the creek worthy of improvement, '91, 943.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Gillespie, '91, 943.

**CHARLESTON HARBOR, S. C., including Sullivans Island.—  
IMPROVEMENT OF.**

(Continued from Vol. II, p. 114.)

**Appropriations.**

1852-'87 .....	\$1, 632, 200
1888 .....	350, 000, '88, 975.
1890 .....	370, 000, '90, 1193.
1892 .....	225, 000, '92, 1223.

Total ..... 2, 577, 200

List of appropriations, '88, 975; '91, 1470.

**Commerce.**

Commerce of Charleston, '89, 1155.

**Contracts.**

1889. C. McK. Grant and J. W. Egan, for jetty construction, at an aggregate of \$213,550, '89, 1147. B. C. Howell, for dredging, at 17½ cents per cubic yard, '89, 1147.

1890. J. Friday, for riprap stone, at \$1.90 and \$2.15 per ton, '91, 1471.

1891. H. W. Crouch, for breakwater construction, at \$4,300, '92, 1224.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 134; '89, 149; '90, 134; '91, 175; '92, 173.

BOARD OF ENGINEERS.

Convened at Washington November 10, 1888, by S. O. No. 50, to examine and report upon Capt. Abbot's revised project for the improvement of Charleston Harbor.

Report, '89, 1150. (Lieut. Cols. Gillespie and King and Maj. Post.)

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888-'—. Reports, '88, 970; '89, 1144, 1151, 1153; '90, 1190; '91, 1467; '92, 1219.

ASSISTANT.

J. P. Allen. Reports, '88, 975; '89, 1147; '90, 1193; '91, 1471; '92, 1224.

**Operations.**

1887-'88. 7,177 cubic yards stone and 926 square yards log mattress placed in south jetty; 7,613 cubic yards stone used on south jetty, '88, 972.

1888-'89. 1,921 tons of riprap deposited at outer end of south jetty, '89, 1145.

1889-'90. 21,353 tons riprap deposited at outer end of north jetty, and 34,012 tons upon south jetty; 56,626 cubic yards material dredged, '90, 1190.

1890-'91. 43,264 tons stone deposited on the south jetty and in the main ship channel; 47,626 cubic yards material dredged from the main ship channel, '91, 1468.

1891-'92. 19,284 tons stone deposited in south jetty under contract, and 52,439 tons by hired labor; 32,966 tons stone deposited in north jetty under contract, and 1,202 tons by hired labor, '92, 1224.

**Projects.**

By Col. Gillmore, 1878, for the purpose of establishing and permanently maintaining a practicable channel across the bar of not less than 21 feet depth at mean low water, by means of two converging jetties of random stone on brush and log mattresses, with an opening between the ends of the jetties of about 2,900 feet; estimated cost, \$3,000,000, '78, 558, 572; '86, 176; '87, 1135.



# **CHARLESTON HARBOR, S. C., including Sullivans Island—Continued.**

## **Projects—Continued.**

In 1889 it was estimated that to bring the jetties to low-water level throughout would require \$2,548,000 in addition to prior appropriations, making the total estimated cost of the jetties, if left at mean low-water level throughout, \$4,380,500, '89, 1144; '90, 1190; '91, 1470; '92, 1220.

## **Surveys.**

### **MAPS.**

'88, 984; '89, 1146; '90, 1192; '91, 1470; '92, Atlas, 45, 46, 47.

# **CHARLEVOIX HARBOR AND ENTRANCE TO PINE LAKE, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 116.)

## **Appropriations.**

1876-'87 .....	\$81, 000
1888.....	12, 500, '88, 1901.
1889.....	9, 000, '90, 2611.
1892.....	10, 000, '92, 2317.

Total ..... 112, 500

List of appropriations, '92, 2317.

## **Contracts.**

1889. G. W. Crouter, for pier constructions, at a total of \$8,595.30, '89, 2166.

1891. Gaylord & Wing, for piles, at 10 cents per linear foot, and white pine timber, at \$18 per M feet, B. M. G. W. Crouter, for bolts, at 3 cents per pound. Trunan & Cooper, for brush, at \$6 per cord. F. A. Hagen, for stone, at \$2.24 per cord, '91, 2673.

## **Engineers.**

### **CHIEF OF ENGINEERS.**

Reports, '88, 251; '89, 294; '90, 264; '91, 336; '92, 2315.

### **ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1899.

Maj. W. Ludlow, 1889-'— Reports, '89, 2164; '90, 2610; '91, 2672; '92, 2315.

## **Operations.**

1887-'88. 354 linear feet of plank-beam revetment placed in north side of channel; 45,000 cubic yards material dredged from between the piers; south pier extended 50 feet, '88, 1900.

1888-'89. Three cribs built and repairs made to end of north pier by contract; 2,500 cubic yards material dredged by hired labor, '89, 2164.

1889-'90. 5,760 cubic yards material dredged by hired labor, '90, 2610.

1890-'91. 33,500 cubic yards material dredged, and repairs made to upper channel revetments, '91, 2672.

1891-'92. Repairs to revetment in lower channel, and gap between north pier and revetment at shore line filled with brush and stone, '92, 2316.

## **Physical Characteristics.**

Description of drainage area, '89, 2165.

## **Projects.**

By Maj. Mansfield, 1868, for improvement of harbor by dredging a channel 100 feet wide to a depth of 12 feet, both sides to be protected by close piling; modified in 1876 by the substitution of crib for pile piers, at an estimated cost of \$186,000, '69, 80, 81, 82; '80, 214; '87, 2177.

# **CHARLOTTE HARBOR AND PEASE CREEK, FLA.—IMPROVEMENT OF.**

## **Appropriations.**

1881-'88 .....	\$16, 000
1890.....	35, 000, '91, 1648.

Total ..... 51, 000

## **Commerce.**

Commercial interests to be subserved by improvement, '91, 1682.

**CHARLOTTE HARBOR AND PEASE CREEK, FLA.—Continued.****Contracts.**

1891. Alabama Dredging and Jetty Company, for dredging, at 25 cents per cubic yard, '91, 1647.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 190, 196; '92, 187.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1890-'92. Reports, '91, 1646, 1681, 1683, 1684.

Maj. J. C. Mallery, 1892-'—. Report, '92, 1379.

**ASSISTANT.**

J. H. Bacon. Report, '91, 1648.

**Operations.**

1890-'91. Excavation of channel begun under contract, '91, 1647.

1891-'92. No operations, '92, 1380.

**Physical Characteristics.**

Description of the locality, '91, 1646.

**Projects.**

By Capt. Black, 1891, for excavation of a 12-foot channel, from 50 to 60 feet wide, across all the shoals between Boca Grande and Punta Gorda; estimated cost, \$35,000, '91, 1684.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Black, '91, 1684.

**MAPS.**

'91, 1650, 1685.

**CHARLOTTE HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 118.)

**Appropriations.**

1828-'87 .....	\$399,328.40
1888 .....	45,000.00, '88, 2072.
1890 .....	25,000.00, '90, 2852.
1892 .....	25,000.00, '92, 2556.

Total .....	494,328.40
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 282; '89, 333; '90, 302; '91, 378; '92, 357.

**ENGINEERS IN CHARGE.**

Capt. C. F. Palfrey, 1886-'90. Reports, '88, 2069; '89, 2407.

Maj. M. B. Adams, 1890-'91. Reports, '90, 2849, 2854.

Capt. D. C. Kingman, 1891-'—. Reports, '91, 2849; '92, 2551.

**Operations.**

1887-'88. 1,400 linear feet of west pier superstructure rebuilt; breaches in west pier repaired; pocket in east pier rebalasted; 156 detached piles removed; work done by hired labor, '88, 2070.

1888-'89. 20,000 cubic yards material dredged; repairs to east and west piers, '89, 2409.

1889-'90. 98,377 cubic yards material dredged, '90, 2851.

1890-'91. Superstructures of Section E of east jetty rebuilt for a distance of 995 linear feet; repairs to outer end of east pier; 18,680 cubic yards material dredged from the channel, '91, 2901.

1891-'92. 83,513 cubic yards material dredged; west jetty superstructure renewed; repairs to superstructure on east and west jetties, '92, 2555.

**Physical Characteristics.**

Description of the locality, '88, 2072.

**Projects.**

The projects of 1829-'80 were modified in 1881 by Maj. McFarland, to provide for an extension of the piers to the 15-foot curve in the lake, with the formation, by dredging, of a channel between the piers 15 feet deep; estimated cost, \$154,000, '81, 2437; '86, 343. Modified in 1889 to provide for the maintenance of existing works, and of a channel 200 feet wide and 16 feet deep, at extreme low water. Estimate for completion, including appropriation of 1890, \$31,400, '90, 2852.

**CHARLOTTE HARBOR, N. Y.—Continued.****Projects—Continued.**

By Capt. Kingman, 1891, to secure and maintain, by pier extension and dredging, a channel of navigable width, and 15 feet deep, at extreme low water; estimated cost for completion, \$109,650, '92, 2556.

**CHATHAM HARBOR, MASS.—IMPROVEMENT OF.****Appropriations.**

1890..... \$5,000, '91, 667.

**Contracts.**

1891. C. W. Anthony, for dredging, at 41 cents per cubic yard, '92, 596.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 46; '92, 51.

ENGINEER IN CHARGE.

Lieut. Col. S. M. Mansfield, 1890— Reports, '91, 667; '92, 595.

**Operations.**

1890-'91. No operations, '91, 667.

1891-'92. 8,794 cubic yards material dredged, '92, 595.

**Projects.**

By Lieut. Col. Mansfield, 1890, for improvement of the inner harbor by excavation of a channel 6 feet deep at mean low water, through the three obstructing bars, 100 feet wide at the inner and 200 feet wide at the outer end; estimated cost, \$10,000, '91, 667.

**CHATTAHOOCHEE RIVER, GA. AND ALA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 119.)

**Appropriations.**

1835-'87 .....	\$155,000
1888 .....	20,000, '88, 1183.
1890 .....	20,000, '90, 1648.
1892 .....	25,000, '92, 1406.

Total ..... 220,000

List of appropriations, '88, 1182; '91, 1702.

**Commerce.**

Navigation benefited by improvement, '90, 1646.

**Contracts.**

1888. M. A. Sweeney & Bro., for construction of drilling barge, at \$3,400, and dumping flat, at \$600, '89, 1395.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 156; '89, 181; '90, 164; '91, 199, 211; '92, 195.

ENGINEERS IN CHARGE.

Capt. R. L. Honie, 1885-'89. Report, '88, 1181.

Capt. P. M. Price, 1889— Reports, '89, 1393; '90, 1645; '91, 1702; '92, 1406.

ASSISTANT.

T. Robinson. Reports, '89, 1395; '90, 1646; '91, 1758.

**Operations.**

1887-'88. 3,818 cubic yards marl and 1,354 snags, logs, and trees removed from the river; repairs made to jetties at Mound Bar, '88, 1182.

1888-'89. 753 cubic yards rock and 2,225 logs, snags, and overhanging trees removed from the channel, '89, 1395.

1889-'90. 576 cubic yards rock and 904 snags and logs removed from the channel, '90, 1647.

1890-'91. 25 trees cleared from the banks, 10 snags and 166 cubic yards marl removed from the channel, and extensive repairs made to snag boat *Chattahoochee*, '91, 1702.

1891-'92. 366 snags and 1,500 cubic yards gravel removed from channel; 1,100 linear feet pile-and-brush bank protection and jetty work built, '92, 1406.

**CHATTANOOCHEE RIVER, GA. AND ALA.—Continued.****Plans.**

In 1890 Col. Comstock did not consider the river between West Point and Franklin worthy of improvement, '91, 1758.

**Projects.**

By Capt. Damrell, 1873, for improvement of the Chattahoochee River, from its mouth to Columbus, 224 miles, by formation of a channel 100 feet wide and 4 feet deep at low water, by blasting, dredging, removal of snags and logs, and the construction of wing dams, '73, 700; '80, 1070; '86, 200. Original estimate stated as \$385,274, '86, 1169; '87, 1283.

**Surveys.**

Examination between West Point and Franklin ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Price, '91, 1757.

**CHEAT RIVER, W. VA.—IMPROVEMENT OF.****Appropriations.**

1890..... \$13,000, '91, 2361.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 254; '91, 291; '92, 279.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. E. Merrill, 1888-'92. Reports, '89, 1905; '91, 2361.

Maj. A. Stickney, 1892-'—. Report, '92, 1991.

**ASSISTANTS.**

C. E. Rees. Report, '89, 1906.

P. Golay. Reports, '91, 2361; '92, 1991.

**Operations.**

1890-'91. 5,626 cubic yards of rock cleared from the channel, '91, 2361.

1891-'92. 8,221 cubic yards rock blasted and removed from the channel, '92, 1991.

**Physical Characteristics.**

Description of the locality, '89, 1905.

**Projects.**

By Lieut. Col. Merrill, 1889, for improvement of the river from its mouth at Point Marion to Rowlesburg, W. Va., a distance of 49 miles, by blasting and removing rock obstructions to give a raft navigation, at an estimated cost of \$13,000, '89, 1906; '91, 2361.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Merrill, '89, 1905.

**CHEBOYGAN HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 120.)

**Appropriations.**

1871-'87..... \$133,000

1888..... 15,000, '88, 1960.

Total..... 148,000

List of appropriations, '92, 2449.

**Contracts.**

C. E. Mitchell, for dredging, at 14.4 cents per cubic yard, '88, 1960.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 261; '89, 309; '90, 278; '91, 348; '92, 334.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1883-'—. Reports, '88, 1958; '89, 2243; '90, 2719; '91, 2764; '92, 2448.

**Operations.**

1887-'88. 29,979 cubic yards of material dredged, '88, 1959.

1888-'89. 28,472 cubic yards of material dredged, '89, 2244.

1889-'90. 31,204 cubic yards of material dredged, '90, 2720.

1890-'92. No operations; project completed, '91, 2764; '92, 2448.

**CHEBOYGAN HARBOR, MICH.—Continued.****Projects.**

By Capt. Farquhar, 1870, for improvement of the harbor by dredging a channel 200 feet wide and 14 feet deep from the mouth of the river to Cheboygan village, and the protection of the channel by pile piers with crib pier heads; estimated cost, \$395,000, '71, 185, 186; '80, 219; '87, 2247.

In 1885 Col. Poe reduced the estimate for the present project to \$218,000, '85, 2128; '87, 2248. In 1888 Col. Poe proposed the continuation of the 15-foot channel upstream to the State Road Bridge. The present project therefore proposes a channel 15 feet deep and 200 feet wide from the 15-foot curve in the Straits of Mackinaw to the first bridge, and the revetting of both sides of the channel outside the shore line; estimated cost, \$218,000, '88, 1959.

Project completed in 1890, at a cost of \$129,648, '91, 2720; '92, 2448.

**CHEESEQUAKES CREEK, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 121.)

**Appropriations.**

1880-'82..... \$40,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 73.

ENGINEER IN CHARGE.

Capt. G. McC. Derby, 1886. Report, '88, 661.

**Operations.**

1887-'88. No operations for lack of funds, '88, 661.

**Projects.**

By Col. Newton, 1879, to change the outlet into a direction at right angles to the beach and to sustain this direction by parallel jetties to strengthen the course of the stream and increase the depth to 4 feet mean low water; estimated cost, \$75,279, '80, 525, 527; '82, 680. Estimate revised in 1885 to \$90,000, '85, 743; '87, 743.

**CHEHALIS RIVER, WASH.—IMPROVEMENT OF.**

(See also GRAYS HARBOR, WASH.)

(Continued from Vol. II, p. 121.)

**Appropriations.**

1882-'87..... \$8,000  
 1888..... 2,000, '88, 2175.  
 1890..... 3,000, '90, 2986.

Total..... 13,000

List of appropriations, '91, 3237.

**Contracts.**

1889. T. S. Tew, for hire of boat and snagging outfit, at \$31.67 per day, '89, 2560.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 302; '89, 360; '90, 323; '91, 407; '92, 382.

ENGINEERS IN CHARGE.

Maj. T. H. Handbury, 1888-'90. Reports, '88, 2174; '89, 2559.

Capt. T. W. Symons, 1890-'—. Reports, '90, 2984; '91, 3236; '92, 2726.

**Operations.**

1887-'88. 353 snags and 129 overhanging trees removed, '88, 2175.

1888-'89. 60 snags and 5 overhanging trees removed, '89, 2560.

1889-'90. 56 snags cleared from the channel, '90, 2985.

1890-'91. 60 snags and 51 stumps removed from the channel between Montesano and Grays Harbor, '91, 3237.

1891-'92. 8 snags cleared from the channel, '92, 2727.

**Projects.**

By Capt. Powell, 1882, for removal of snags, logs, drift, and similar obstructions between Claquato and the mouth, a distance of 70 miles, giving a navigable channel of 3 feet for two-thirds of the year, at an estimated annual cost of \$8,000, '82, 2687, 2688.

**CHESTER RIVER, MD.—IMPROVEMENT OF, AT KENT ISLAND NARROWS.**

(Continued from Vol. II, p. 124.)

**Appropriations.**

1876-'79 .....	\$41,000
1890 .....	5,000, '90, 954.
1892 .....	3,000, '92, 971.

Total ..... 49,000

List of appropriations, '88, 747.

**Contracts.**

1891. National Dredging Company, for dredging, at 10 cents per cubic yard, '91, 1189.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 112; '90, 102; '91, 126; '92, 126.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1884-'— Reports, '88, 747; '90, 954; '91, 1188; '92, 970.

ASSISTANT.

A. Stierle. Report, '90, 955.

**Operations.**

1887-'88. No operations, '88, 747.

1890-'91. Excavation of channel begun under contract, '91, 1788.

1891-'92. 20,061 cubic yards material dredged, '92, 971.

**Plans.**

By Mr. W. F. Smith, 1889, for excavation of a channel, from Crampton to a point one mile below Millington, 60 feet wide and 6 feet deep at mean low water; estimated cost, \$12,750, '90, 956.

**Projects.**

By Lieut. Col. Craighill, 1874, for the improvement of this part of Chester River, by the reopening of a channel formerly existing between Chester River and Eastern Bay, which has been closed by a solid causeway, under the authority of the State of Maryland; estimated cost, \$25,000, '75, ii, 64; '85, 133. Project completed, at a cost of \$25,000, in 1878; no further work deemed necessary, '85, 133.

In 1889 Mr. W. F. Smith proposed the improvement of the river, between Chester and Jones Landing, by excavation of a channel from Crampton to a point one mile below Millington, supposed to be Jones Landing, a distance of 6½ miles, 60 feet wide and 6 feet deep at mean low water; estimated cost, \$12,750, '90, 956; '91, 1186; '92, 971.

**Surveys.**

Survey between Crampton and Jones Landing ordered by act of August 11, 1888. Made, 1889, under direction of Mr. W. F. Smith, '90, 956.

**CHICAGO HARBOR, ILL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 125.)

**Appropriations.**

1833-'87 .....	\$1,804,005
1888 .....	200,000, '88, 1888.
1890 .....	100,000, '90, 2402.
1892 .....	72,000, '92, 2239.

Total ..... 2,176,005

**Contracts.**

1888. F. R. Crane, for dredging, at 13½ cents per cubic yard, '89, 2112. The Fitz-Simons &amp; Connell Company, for breakwater construction, at a total of \$118,117.87, '89, 2112.

1891. Kimball &amp; Cobb Stone Company, for superstructure reconstruction, at a total of \$85,335.38, '91, 2599.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 247; '89, 287; '90, 257; '91, 329, 426; '92, 315.

BOARD OF ENGINEERS.

Convened at Chicago, September 17, 1890, by S. O. No. 61, to report upon the establishment of harbor lines in Chicago Harbor. Report, '91, 2661. (Col. Poe, Maj. Davis, and Capt. Marshall.)

**CHICAGO HARBOR, ILL.—Continued.****Engineers—Continued.****ENGINEER IN CHARGE.**

Capt. W. L. Marshall, 1888-'— Reports, '88, 1886; '89, 2110; '90, 2399; '91, 2596; '92, 2237.

**ASSISTANTS.**

J. C. Almy. Report, '89, 2113.

G. A. M. Liljencrantz. Reports, '90, 2402; '91, 2599; '92, 2240.

**Operations.**

1887-'88. 95 linear feet of concrete superstructure laid; 400 linear feet of substructure laid in extension of the exterior breakwater, '88, 1887.

1888-'89. 400 linear feet superstructure built over outer extremity of exterior breakwater; substructure of exterior breakwater extended 408 feet; 4 cribs built to repair gap in southerly breakwater; 25,280 cubic yards material dredged, '89, 2110.

1889-'90. 748 linear feet substructure and 1,156 linear feet superstructure built at exterior breakwater; 5 cribs placed in southerly breakwater gap, '90, 2399.

1890-'91. 1,700 linear feet of east breakwater superstructure rebuilt, '91, 2597.

1891-'92. Superstructure over easterly breakwater completed; superstructure built over north pier and repairs made to the same, '92, 2240.

**Projects.**

The work for the improvement of this harbor was commenced by the United States under its first appropriation in 1833 and continued at irregular intervals to 1864, and thereafter more regularly to 1870, at which latter date the basis of the present project was adopted. Between 1833 and 1870 the project consisted in the formation of a channel of entrance to mouth of river between two piers extending into the lake, and between which a channel of about 14 feet was obtained. The amount appropriated from 1833-'69, inclusive, was \$416,005, '76, ii, 433; '79, 1555. Between 1870 and 1876 additional extensions were made to the north and south piers, '70, 96; '76, ii, 426, 435. In 1870 the project for an outer harbor was adopted, contemplating the construction of an easterly breakwater 4,000 feet long, about 3,300 feet from the shore, and a southeasterly breakwater about 3,000 feet long, the protected area being about 455 acres, of which 185 acres were reserved for piers and slips, and 270 acres, with a depth dredged to 16 feet, for harborage, '70, 101, 124; '76, ii, 435; '79, 1555; '86, 1702.

In 1878 the project was further modified by an additional breakwater about 5,400 feet long, and to be placed north and east of the harbor entrance, '79, 1561; '81, 2153, 2162; '86, 306. The amount appropriated from 1870-'86, inclusive, was \$1,358,000, and in 1886 it was estimated that \$240,000 was required to complete existing project, '86, 1703; '87, 2113.

In 1888 the estimate for completion of existing project, including superstructure construction over easterly breakwater in the outer harbor, completion of exterior breakwater and outer basin, and dredging at the harbor entrance, was increased to \$372,000, '88, 1887; '91, 2599.

**Surveys.****MAPS.**

'89, 2112; '90, 2402; '91, 2599; '92, Atlas, 104.

**CHICKAHOMINY RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 127.)

**Appropriations.**

1878-'87 .....	\$19,000
1888 .....	2,500, '88, 834.
1890 .....	2,500, '90, 1080.
1892 .....	5,000, '92, 1092.

Total ..... 29,000

List of appropriations, '88, 834; '92, 1092.

**Contracts.**

1889. American Dredging Company, for dredging, at 14 cents per cubic yard, '89, 1019.

1891. C. T. Caler, for dredging, at 15½ cents per cubic yard, '91, 1300.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 114; '89, 132, 135; '90, 119, 121; '91, 149, 153; '92, 151.

**CHICKAHOMINY RIVER, VA.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1874-'91. Reports, '88, 832; '89, 1018; '90, 1079, 1085, 1086.

Capt. G. J. Fiebeger, 1891-'92. Report, '91, 1299, 1305.

Lieut. E. Burr, 1892-'— . Report, '92, 1091.

**ASSISTANT.**

J. P. White. Report, '91, 1306.

**Operations.**

1887-'88. No operations for lack of funds, '88, 833.

1888-'89. 10,321 cubic yards material dredged, '89, 1019.

1889-'90. 777 cubic yards material dredged, '90, 1079.

1890-'91. No operations, '91, 1299.

1891-'92. 13,060 cubic yards material dredged, '92, 1092.

**Physical Characteristics.**

Description of the locality, '90, 1085.

**Plans.**

By Mr. S. T. Abert, 1888, for improvement of the creek between Windsor Shades and Ropes Neck by removal of snags, trees, stumps, and similar obstructions; estimated cost, \$4,000, '90, 1089.

In 1891 Capt. Fiebeger did not consider the river between Holly Landing and Long Bridge worthy of improvement, '91, 1306.

**Projects.**

By S. T. Abert, 1878, for improvement of Chickahominy River by excavation of channels 100 to 150 feet wide through Binns, Old Fort, and Windsor Shades bars, to a depth of 8 feet at low water; estimated cost, \$15,000, '79, 619; '80, 115. Increased in 1882 for a channel through the bar at the mouth to \$18,000, '82, 1043. Increased, in 1885, \$1,000, '85, 988. In 1887 it was estimated that \$10,000 was required to complete the project, '87, 947.

By S. T. Abert, 1890, for excavation of a channel from 100 to 150 feet wide and at least 8 feet deep at low water through the bar at the mouth; estimated cost, \$7,500, '91, 149, 1299.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Mr. S. T. Abert, '90, 1086.

Examination from Holly Landing to Long Bridge ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Fiebeger, '91, 1306.

**MAPS.**

'89, 1018.

**CHICKASAHAY RIVER, MISS.—IMPROVEMENT OF.****Appropriations.**

1890..... \$5,000, '91, 1792.

1892..... 5,000, '92, 1456.

Total ..... 10,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 193; '91, 218; '92, 211.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1888-'—. Reports, '89, 1463; '91, 1791; '92, 1456.

**Operations.**

1891-'92. 6,000 overhanging trees felled upon the banks, and 6,000 logs cleared, '92, 1456.

**Plans.**

By Maj. Damrell, 1889, for improvement of the river from its mouth up to the railroad bridge near Shubuta, by removal of logs, snags, and overhanging trees, giving a 3-foot depth at low water; estimated cost, \$30,000; also, for a channel 2 feet deep and 65 feet wide from Shubuta up to Enterprise, at a cost of \$100,000, '89, 1465.

**Projects.**

By Maj. Damrell, 1889, to secure a 3-foot navigable channel from the mouth up to the railroad bridge near Shubuta, by removal of logs, snags, and overhanging trees, at an estimated cost of \$30,000, '89, 1465; '91, 1791; '92, 1456.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Damrell, '89, 1463.



**CHINCOTEAGUE BAY TO DELAWARE BAY.—IMPROVEMENT OF  
INLAND WATER WAY BETWEEN.**

(Continued from Vol. II, p. 123.)

**Appropriations.**

1886-'87.....	\$18,750
1888.....	50,000, '88, 746.
1890.....	50,000, '90, 932.
1892.....	25,000, '92, 965.

Total..... 143,750

**Commerce.**

Amount of, interested in the improvement, '88, 746; '89, 893.

**Contracts.**

1889. C. McLean, for dredging, at 21.9 cents per cubic yard, '89, 892.

1890. W. H. Virden, for construction of three bridges, at a total cost of \$1,193, '90, 932.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 91; '89, 106; '90, 97; '91, 123; '92, 123.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885-'— Reports, '88, 745; '89, 892; '90, 930; '91, 1068, 1171; '92, 956.

**ASSISTANT.**

A. Stierle. Reports, '91, 1174; '92, 962.

**Operations.**

1887-'88. No operations, '88, 745.

1888-'89. 46,619 cubic yards material dredged, '89, 892.

1889-'90. 64,209 cubic yards material dredged.

1890-'91. Excavation of cut between Assawoman and Indian River bays completed, and three temporary wooden bridges erected, '91, 1170.

1891-'92. Draws placed in three wooden bridges, '92, 957.

**Physical Characteristics.**

Description of the country through which the proposed canal route would extend, '91, 1174.

**Plans.**

By W. F. Smith, 1891, for excavation of a canal between Rehoboth and Delaware bays, at an estimated cost of, (1) by the Lone Creek route, \$460,224; (2) by the Burton Creek route, \$692,132; (3) by the Stockley Creek route, \$574,581, '91, 1178, 1179. Stockley Creek route considered the best, '91, 1180.

**Projects.**

By W. F. Smith, 1885, for an inland navigation between Chincoteague and Delaware bays, a distance of 73 miles, by the formation, where necessary, of a dredged channel 70 feet wide and 6 feet deep at mean low water; estimated cost, \$350,000, '85, 897, 879, 904; '91, 1169; '92, 956.

**Surveys.**

Survey for canal between Rehoboth and Delaware bays. Made, 1891, under direction of W. F. Smith, '91, 1174.

**CHINCOTEAGUE INLET, VA.—SURVEY OF BREAKWATER AT.**

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 112; '90, 102.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent. Report, '90, 980.

**ASSISTANTS.**

D. C. Hudson. Report, '90, 980.

A. Stierle. Report, '90, 982.

**Physical Characteristics.**

Description of the locality, '90, 980.

**Plans.**

By Mr. W. F. Smith, 1890, for improvement of the inlet by construction of 1,200 linear feet of stone breakwater and 15,150 linear feet of jetty at Wallops Beach and Fishing Point; estimated cost, \$3,782,688, '90, 982.

**Surveys.**

Survey for breakwater ordered by act of August 11, 1888. Made, 1890, under direction of Mr. W. F. Smith, '90, 981.

**CHIPPEWA RIVER, INCLUDING YELLOW BANKS, WIS.—**  
IMPROVEMENT OF.

(Continued from Vol. II, pp. 129, 130.)

**Appropriations.**

1876-'87. Chippewa River.....	\$86,750	
1888. Yellow Banks.....	30,000	
1888. Chippewa River, including Yellow Banks...	10,000,	'88, 1546.
1890.....	10,000,	'90, 2086.
1892.....	5,000,	'92, 1836.

Total..... 141,750

List of appropriations, '91, 2202; '92, 1835.

**Commerce.**

Lumber interests, '89, 1796.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 203; '89, 236; '90, 212; '91, 270; '92, 258.

ENGINEERS IN CHARGE.

Maj. C. J. Allen, 1878-'90. Reports, '88, 1542; '89, 1794.

Maj. W. A. Jones, 1890-'—. Reports, '90, 2084; '91, 2201; '92, 1833.

**Operations.**

1887-'88. Training dam at Eau Claire leveled off and repaired; dam at Dark Slough repaired and extended 95 feet; brush and stone dams at Five Mile Bluff, Battle Island, and Dead Lake Cut-off, and jetties at mouth of river repaired; shore revetment at head of east jetty extended 150 feet; repairs to revetment at Yellow Banks, '88, 1542-45.

1888-'89. 1,305 linear feet of wing dam built at Plum Island Flats; 576 linear feet of dam and revetment built at Battle Island, Dark Slough, and Waconta Island dams. Repairs to existing works; 3,026 cubic yards stone and 1,314 cubic yards brush used, '89, 1795.

1889-'90. Repairs to east and west jetties at mouth of river; 90 cords stone and 164 cords brush used, '90, 2085.

1890-'91. No operations, '91, 2202.

1891-'92. Pile boom built at Dead Lake Cut-off; Plum Island Flats Dam No. 2 built, and foundation courses of Dam No. 3 laid, '92, 1834.

**Projects.**

By Maj. Farquhar, 1875, for improvement of Chippewa River, Wis., from Eau Claire to the mouth, by dredging, construction of wing dams, and removal of obstructions; estimated cost, \$139,892.50, of which amount \$64,102.50 was estimated as the cost of protecting the "Yellow Banks" from erosion, '77, 574; '80, 179.

By Maj. Allen, for the protection of about 26,000 linear feet of river bank at five points below Eau Claire; estimated cost, \$96,000, '83, 1442; '86, 1489.

In 1883 the estimate for improvement of the Chippewa was revised by omitting cost of work at Yellow Banks and increasing the cost of the remaining work to \$132,476, '83, 1440; '87, 1699. From 1876 to 1886, inclusive, \$116,750 was appropriated; estimated cost of completion of existing project in 1887, \$55,523, '87, 1701, 1702.

In 1888 \$45,552 was estimated as required for completion of the Chippewa River improvement, and \$66,000 for completion of improvement at Yellow Banks, making a total for completion of both projects of \$111,552, '88, 1544-46. Increased in 1889 to \$115,737.72, '89, 1797; '91, 2201.

**CHOCTAWHATCHEE RIVER. FLA. AND ALA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 130.)

**Appropriations.**

1832-'87.....	\$92,000	
1888.....	10,000,	'88, 1168.
1890.....	12,500,	'90, 1633.
1892.....	12,500,	'92, 1411.

Total..... 127,000

List of appropriations, '88, 1167; '89, 1381; '91, 1707.

**Commerce.**

Increase in cotton shipments, '89, 1382.

**CHOCTAWHATCHEE RIVER, FLA. AND ALA.—Continued.****Contracts.**

M. A. Sweeney, for snag-boat construction, at \$4,800, '89, 1383.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 153; '89, 178, 185; '90, 160; '91, 201; '92, 197.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1166.

Capt. P. M. Price, 1889-'—. Reports, '89, 1380, 1423; '90, 1631; '91, 1707; '92, 1409.

**ASSISTANTS.**

W. A. Gould. Report, '90, 1633.

W. G. Williamson. Report, '89, 1425.

J. E. Turtle. Reports, '91, 1708; '92, 1410.

**Legislation.**

Law passed by Alabama legislature to prohibit the driving of loose logs in the Choctawhatchee River, within the State of Alabama, '89, 1382.

**Operations.**

1887-'88. 5,772 logs and snags removed from the channel, '88, 1168.

1888-'89. 3,183 trees, logs, and snags removed from the channel, and 695 trees from the banks, '89, 1382.

1889-'90. Removal of snags, stumps, and channel obstructions continued, '90, 1633.

1890-'91. Removal of snags and similar obstructions continued, '91, 1708.

1891-'92. 2,142 snags removed from the channel, and 386 trees cleared from the banks, '92, 1410.

**Plans.**

By Capt. Price, 1889, for excavation of a channel 60 feet wide and 3 feet deep between Geneva and Newton, by dredging shoals and removing snags and logs; estimated cost, \$57,125, '89, 1424.

**Projects.**

By Col. Simpson, 1872, for improvement of Choctawhatchee River from its mouth to Geneva, a distance of 212 miles, by removal of snags, sunken logs, etc.; estimated cost, \$44,332, '74, 896; '81, 1194.

By Maj. Damrell, 1880, for improvement of the river from Geneva to Newton, a distance of 40 miles, by removal of obstructions and construction of 3 locks and dams; estimated cost, \$78,500, '80, 1081; making an aggregate of \$122,832 for the improvement of the river from its mouth to Newton, '86, 1177; '87, 1272.

**Surveys.**

Examination for a low-water channel from Geneva to Newton ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Price, '89, 1423.

**CHOPTANK RIVER, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 131.)

**Appropriations.**

1880-'87 .....	\$30,000
1888.....	7,500, '88, 749.
1890.....	7,500, '90, 939.
1892.....	3,000, '92, 972.

Total ..... 48,000

List of appropriations, '89, 901; '91, 1190.

**Commerce.**

Value of the improvement to, '88, 748.

**Contracts.**

1889. American Dredging Company, for dredging, at 15 cents per cubic yard, '90, 938.

1891. C. T. Caler, for dredging, at 14½ cents per cubic yard, '91, 1191.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 93; '89, 110; '90, 100; '91, 127; '92, 127.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885-'—. Reports, '88, 748; '89, 900; '90, 938; '91, 1189; '92, 972.

**Operations.**

1887-'88. 45,220 cubic yards material dredged from the channel, '88, 748.

1888-'89. No operations, '89, 901.

**CHOPTANK RIVER, MD.—Continued.****Operations—Continued.**

1889-'90. Dredging resumed, '90, 938.

1890-'91. 43,827 cubic yards material dredged, '91, 1189.

1891-'92. No operations, '92, 972.

**Projects.**

By Lieut. Col. Craighill, 1880, for the formation of a dredged channel, 75 feet wide and 8 feet deep at mean low water, between Denton and Gainsborough. Estimated cost, \$79,000, '80, 636; '87, 94; '91, 1190; '92, 972.

**CHRISTIANA RIVER, DEL.—(See WILMINGTON HARBOR, DEL.)****CHUCKATUCK CREEK, VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 120.

ENGINEER IN CHARGE.

Lieut. G. J. Fiebeger. Report, '89, 968.

ASSISTANTS.

J. Riddle. Report, '89, 969.

T. I. George. Report, '89, 970.

**Physical Characteristics.**

Description of the locality, '89, 969.

**Plans.**

In 1888 Lieut. Fiebeger did not consider that the present or prospective demands of commerce warranted any improvement, '89, 969.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Fiebeger, '89, 968.

**CLACKAMAS RIVER, OREG.<sup>1</sup>—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 357.

ENGINEER IN CHARGE.

Capt. W. Young. Report, '89, 2523.

**Physical Characteristics.**

Description of the locality, '89, 2524.

**Plans.**

In 1888 Capt. Young did not consider the river worthy of improvement, '89, 2524.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Young, '89, 2523.

**CLARENDON AND LOWER WHITE RIVERS, ARK.—SURVEY TO PREVENT INJURY FROM BACKWATER FROM THE MISSISSIPPI RIVER.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 257; '92, 247, 1697.

ENGINEERS IN CHARGE.

Capt. H. S. Taber. Report, '92, 1698, 1700.

Col. C. B. Comstock. Report, '92, 1704.

**Physical Characteristics.**

Description of the locality, '92, 1698.

**Plans.**

By Col. Comstock, 1892, for levee construction, 5,100,000 cubic yards, from Helena to the White River, at an estimated cost of \$1,100,000, '92, 1704.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1892, under direction of Capt. Taber, '92, 1700.

**CLARKS CREEK, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 133.)

**Appropriations.**

1888 .....	\$2,500, '88, 129.
1890 .....	2,500, '90, 1204.
1892 .....	2,500, '92, 1207.

Total ..... 7,500

**Commerce.**

Prospective commerce of the creek, '89, 1166.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 128; '89, 151; '90, 136; '91, 172; '92, 171.

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888-'— Reports, '89, 1164; '90, 1203; '91, 1453; '92, 1206.

ASSISTANT.

R. Whitford. Reports, '89, 1165; '90, 1204; '91, 1454; '92, 1207.

**Operations.**

1887-'89. No operations, '88, 128; '89, 1164.

1889-'90. 1,063 trees and snags and 12 cords of small snags removed from the channel, and 195 trees and 35 cords of brush removed from the banks, '90, 1204.

1890-'91. No operations, '91, 1453.

1891-'92. 4,396 snags and logs and 394 cords of small snags removed from the channel, and 553 trees cut from the banks, '92, 1207.

**Projects.**

By Capt. Bixby, 1887, for improvement of the creek by removal of snags and leaning trees, and closing the northern mouth of Lynch's River; estimated cost, \$7,500, '87, 1111; '89, 1164; '91, 1453.

**Surveys.**

MAPS.

'90, 1204.

**CLARKSVILLE HARBOR, MO.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 231.

ENGINEER IN CHARGE.

Capt. E. H. Ruffner. Report, '89, 1722.

**Plans.**

By Capt. Ruffner, 1889, for closing the chute between Clarksville Island and the Illinois shore by a gravel dam 1,000 feet long, and construction of a wing dam above the head of the island from the Illinois shore, in such a direction and of such a length as will serve to confine the channel to the Missouri shore; estimated cost, \$25,000, '89, 1724.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Ruffner, '89, 1722.

**CLEARWATER RIVER, IDAHO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 134.)

**Appropriations.**

1879-'87 ..... \$15,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 306.

ENGINEER IN CHARGE.

Maj. W. A. Jones, 1885. Report, '88, 2189.

**Operations.**

1887-'88. No operations, '88, 2189.

**CLEARWATER RIVER, IDAHO—Continued.****Projects.**

By Maj. Wilson, 1878, for removal of rock and bowlders from Lewiston to mouth of North Fork, forming a channel 60 to 75 feet wide, with a depth of 4 to 5 feet at low water; estimated cost, \$34,424, '79, 1816, 1823; '80, 240; '87, 2523.

**CLEVELAND HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 135.)

**Appropriations.**

1825-'87 .....	\$1,347,994.84
1888 .....	100,000.00, '88, 2004.
1890 .....	75,000.00, '90, 2780.
1892 .....	100,000.00, '92, 2505.

Total ..... 1,622,994.84

List of appropriations, '92, 2504.

**Commerce.**

Report of Board of Industry upon development of lake commerce and necessity for increased harbor facilities, '88, 2008.

**Contracts.**

1888. W. M. Pattison, for drift bolts and spikes, at 2½ cents per pound, '89, 2323. Kelley Island Lime and Transport Company, for furnishing and placing foundation stone, at \$4.89 per cord. J. B. Donnelly, for furnishing stone and timber, at a total of \$65,268, '89, 2324. A. Lacour, for iron, at a total of \$3,926, '89, 2324. 1890. Kelley Island Lime and Transport Company, for furnishing stone, at \$10,680, '91, 2857. L. P. & J. A. Smith, for breakwater extension, at a total of \$47,954, '91, 2857. W. M. Pattison, for iron, at \$3,147, '91, 2857. Carkin, Stickney & Cram, for dredging, at 25 cents per cubic yard, '91, 2859.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 274, 2005; '89, 325; '90, 294; '91, 370; '92, 349.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1883-'92. Reports, '88, 2001, 2006; '89, 2319; '90, 2777; '91, 2853.

Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2503.

**Operations.**

1887-'88. Foundation of 1,200 linear feet of breakwater completed by the deposit of 4,620 cords of stone; 600 linear feet of breakwater parapet and superstructure completed; 3,530 linear feet of parapet wall built; repairs to piers and superstructure by hired labor, '88, 2002, 2003.

1888-'89. Superstructure placed on 7 cribs by hired labor; 7 cribs placed and filled under contract; repairs to piers and breakwater by hired labor, '89, 2320, 2321.

1889-'90. 550 linear feet of breakwater completed under contract; repairs to piers by hired labor; 3,256 cubic yards material dredged, '90, 2778.

1890-'91. 13,300 cubic yards material dredged from channel between the piers and from breakwater basin; extension of east breakwater begun, '91, 2854.

1891-'92. 4,786 cubic yards material dredged; repairs to breakwater, '92, 2503.

**Private and Corporate Work.**

Dredging by city of Cleveland, '90, 2778.

**Projects.**

History of projects previous to 1875, '80, 2135; '87, 2317.

By Board of Engineers, 1875, improvement of Cleveland Harbor by construction of breakwater on west side of mouth of Cuyahoga River; estimated cost, \$1,800,000, '80, 2141, 2143; '85, 2228. Modification by Chief of Engineers, '75, i, 303; '80, 2141. Completed in 1883, at a cost of \$800,000, '85, 2228. Modified in 1884, by Board of Engineers, by an additional breakwater with a parapet; estimated cost, \$500,000, '85, 2235; '87, 2317, 2319. Amount required, in 1888, for completion of the above project, including the appropriation of 1888, \$219,250.

In 1888 Maj. Overman proposed to extend the lake arm of the east breakwater, as at present projected, from about 1,100 feet to 3,500 feet in length, then incline toward the shore on a line parallel with the present projected breakwater, and construct 2,000 linear feet of breakwater, making a total of 5,500 linear feet for the east breakwater, and increasing the anchorage space beyond the 16-foot curve from 75 to 200 acres. Estimated cost of proposed extension, \$300,000. Total, in 1888, for completion of original and revised project, \$519,250, '88, 2004, 2006.

**CLEVELAND HARBOR, OHIO—Continued.****Surveys.****MAPS.**

'88, 2006, 2010; '91, 2856.

**CLINCH RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 137.)

**Appropriations.**

1880-'87 .....	\$26,000
1888 .....	5,000, '88, 1609.
1890 .....	4,000, '90, 2132.
1892 .....	4,000, '92, 1927.

Total ..... 39,000

List of appropriations, '89, 1835; '91, 2265.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 209; '89, 244; '90, 220; '91, 281.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. W. Barlow, 1886-'92. Reports, '88, 1606; '89, 1835; '90, 2131; '91, 2264.

Lieut. Col. H. M. Robert, 1892-'—. Report, '92, 1925.

**Legislation.**

Legislation by State of Tennessee in reference to "fish traps" in the Clinch River, '88, 1608.

**Operations.**

1887-'88. 540 cubic yards rock and gravel excavated; 715 cubic yards riprap quarried; 1,309 cubic yards of dam and 30 linear feet of crib work built, '88, 1607.

1888-'89. 224 cubic yards rock excavated; 1,160 cubic yards riprap quarried; 889 cubic yards riprap dam built, '89, 1836.

1889-'90. 80 linear feet of crib dam built; 528 cubic yards stone placed in dams, and 28 overhanging trees cut, '90, 2132.

1890-'91. Removal of obstructions and dam construction continued, '91, 2265.

1891-'92. 544 cubic yards rock excavated, and 875 cubic yards rock used in construction of wing dams at Llewellyn and Youngs Island shoals, '92, 1926.

**Physical Characteristics.**

Description of the river, '88, 1606.

**Projects.**

By Maj. McFarland, 1876, for obtaining a high-water channel of from 1½ to 2 feet from the mouth to Watkins Ferry, a distance of 145 miles, by construction of wing dams and removal of obstructions for 230 miles; estimated cost, \$26,400, '76, 737; '80, 1680.

After an expenditure of \$21,000, the estimate was increased by Maj. King, 1885, to \$50,000, '85, 1767; '87, 1755, 1757; '91, 2265.

**CLINTON HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 137.)

**Appropriations.**

1882 .....	\$3,000
1890 .....	3,500, '90, 617.
1892 .....	2,000, '92, 668.

Total ..... 8,500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 47; '89, 59; '90, 54; '91, 66; '92, 71.

**ENGINEER IN CHARGE.**

Lieut. Col. D. C. Houston, 1886-'—. Reports, '88, 538; '89, 669; '90, 616; '91, 759; '92, 667.

**Operations.**

1887-'90. No operations for lack of funds, '88, 539; '89, 669; '90, 616.

1890-'91. 836 tons of riprap granite used in extension of the dike, '91, 760.

1891-'92. No operations, '92, 667.

**CLINTON HARBOR, CONN.—Continued.****Physical Characteristics.**

Description of the harbor, '88, 538.

**Projects.**

By Maj. Barlow, 1882, for closing the breach by a riprap stone dike, and if the desired depth was not restored by the increased tidal flow, to dredge channels 100 feet wide and 6 feet deep at mean low water through the two shoals; estimated cost of dike, \$3,000, or of dike and dredging, \$10,000, '82, 630; '86, 634; '87, 596; '92, 667.

**CLINTON RIVER, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 138.)

**Appropriations.**

1852-'87 .....	\$31,500
1888.....	10,000, '88, 1974.
1890.....	10,000, '90, 2744.
1892.....	8,564, '92, 2478.

Total ..... 60,064

**Contracts.**

1888. Hubbell &amp; Skeldon, for furnishing dredge and tug, at \$6.45 per hour, '88, 1974.

1889. Hubbell &amp; Skeldon, for revetment construction and dredging, at a total of \$9,756.16, '90, 2744.

1891. G. Lockerbie, for dredging, at 23½ cents per cubic yard, '91, 2789.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 265; '89, 316; '90, 286; '91, 358; '92, 341.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1883-'—. Reports, '88, 1973; '89, 2270; '90, 2742; '91, 2788; '92, 2477.

**Operations.**

1887-'88. Dredging of channel under contract begun, '88, 1973.

1888-'89. No operations, '89, 2271.

1889-'90. 8,169 cubic yards material dredged, '90, 2743.

1890-'91. 25,906 cubic yards of material dredged, completing the removal of shoals at Green Fence, Tets and Fortons Bends, and Reimolds Bar, '91, 2788.

1891-'92. 23,374 cubic yards material dredged, '92, 2477.

**Projects.**

By Lieut. Col. Poe, 1885, for improvement of entrance by dredging 3,400 feet of channel 100 feet wide and 10 feet deep, and construction of 3,280 linear feet of pile revetment and repairs to pile crib; estimated cost, \$32,926, '85, 2193, 2195; '86, 325; '91, 2788.

**COANJOK BAY, N. C.—(See CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER BAR.)****COASTER HARBOR ISLAND, R. I.—IMPROVEMENT AT.****Appropriations.**

1890..... \$5,500, '91, 719.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 56; '90, 51; '91, 57; '92, 60.

ENGINEERS IN CHARGE.

Maj. W. R. Livermore, 1888-'92. Reports, '90, 590, 591; '91, 718.

Capt. W. H. Bixby, 1892-'—. Report, '92, 624.

**Operations.**

1890-'91. 31,281 cubic yards material dredged, '91, 718.

1891-'92. Work of cutting through the causeway and erecting bridges begun, '92, 625.



**COASTER HARBOR ISLAND, R. I.—Continued.****Projects.**

By Maj. Livermore, 1889, for dredging the cove, and for making two additional openings in the causeway, spanned by wooden bridges; estimated cost, \$5,500, '90, 591.

**Surveys.**

Survey ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Livermore, '90, 591.

**COCHECO RIVER, N. H.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 139.)

**Appropriations.**

1836-'87 .....	\$161,000
1888 .....	9,000, '88, 397.
1890 .....	25,000, '90, 453.
1892 .....	15,000, '92, 530.

Total ..... 210,000

List of appropriations, '88, 396.

**Commerce.**

Decrease in freight charges resulting from the improvement, '90, 453, 475.

**Contracts.**

1889. Thomas Symonds, for dredging, at 45 cents per cubic yard, '89, 542.

1890. C. H. Souther, for dredging, at 39½ cents per cubic yard for soft and \$1.35 for hard material, '91, 608.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 20; '89, 30, 32, '90, 25, 26; '91, 31; '92, 37.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'92. Reports, '88, 396; '89, 542; '90, 453, 475; '91, 607.

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 529.

**ASSISTANT.**

F. S. Burrowes. Report, '90, 477.

**Operations.**

1887-'88. 738 cubic yards solid rock and 530 cubic yards bowlders removed, '88, 396.

1887-'89. 672 cubic yards clay dredged and 4,780 cubic yards clay removed, '89, 542.

1889-'90. No operations; project completed, '90, 453.

1890-'91. No operations, '91, 607.

1891-'92. Channel dredged to 7 feet depth at mean low tide at Dover and at Clements Wharf, '92, 530.

**Physical Characteristics.**

Description of the locality, '90, 475.

**Projects.**

In 1836-'37 \$10,000 was appropriated for the improvement of the Cochecho Branch of the Piscataqua River. The project of 1870 proposed the formation, by rock removal and dredging, of a channel 40 feet wide and 4 feet deep at mean low water through the Lower Narrows and up to the packet landing in Dover, '71, 857; '72, 939; '76, i, 164. This work was accomplished in 1879 under aggregate appropriations of \$95,000, '79, 261; '83, 427; '86, 549.

In 1882 the project was amended so as to provide for a cut-off channel through Alleys Point and widening to 60 feet and deepening to 5 feet through Trickeys and Clements Point shoals; estimated cost, \$28,000, '83, 427.

This work having been accomplished in 1883, Col. Blunt proposed, in 1884-'85, to widen to 50 feet and deepen to 5 feet mean low water all parts of the channel with less dimensions, from Clements Point to the packet landing, at an estimated cost of \$47,000, '84, 471; '85, 475; '87, 466. Project completed in 1889, '89, 542.

After examination and survey in 1889, Lieut. Col. Smith proposed to obtain a channel depth of 7 feet, increased to 7½ when passing over rock, with a minimum width of 50 feet in rock, and 60 feet where the material is less expensive to remove; estimated cost, \$175,000, '90, 477; '91, 607; '92, 530.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Smith, '90, 475.

**COHANSEY CREEK, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 141.)

**Appropriations.**

1873-'82 ..... \$36,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 84.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert, 1885. Report, '88, 714.

**Operations.**

1887-'88. No operations, '88, 714.

**Projects.**

By Lieut. Col. Kurtz, 1872, for dredging channel 130 feet wide and 4 feet deep from lower steamboat landing to Broad Street Bridge, and 3 feet deep to Nail Works Bridge; estimated cost, \$30,000, '73, 889.

Modified, 1879, by Col. Macomb, to make the channel 80 feet wide and from 5 to 7 feet deep, '79, 69, 415; estimate increased to \$41,000, '80, 591.

In 1881-'82 operations were suspended pending the action of the city of Bridgeton.

**COHASSET HARBOR, MASS.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 43.

ENGINEER IN CHARGE.

Lieut. Col. S. M. Mansfield. Report, '89, 595.

**Plans.**

In 1888 Lieut. Col. Mansfield did not consider the expenditure of \$20,000, the cost of dredging an improved channel 1 mile long, 50 feet wide and 10 feet deep at mean low water, warranted by the commercial necessities of the harbor, '89, 595, 596.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Mansfield, '89, 595.

**COLORADO RIVER, TEX. AND ARIZ.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 142.)

**Appropriations.**

1884 ..... \$25,000

1890 ..... 10,000

Total ..... 35,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 348; '91, 235, 393.

ENGINEERS IN CHARGE.

Lieut. Col. W. H. H. Benyaure, 1888-'91. Reports, '89, 2481; '91, 2974.

Maj. C. J. Allen. Report, '91, 1939.

**Physical Characteristics.**

Description of the river, '91, 1939, 2975.

**Plans.**

In 1888 Lieut. Col. Benyaure considered that the cost of an improvement between Camp Mojave and El Dorado Canyon would be greatly in excess of any benefit to be derived therefrom, '89, 2482.

In 1890 Lieut. Col. Benyaure reported the river as unworthy of improvement, '91, 2976.

In 1891 Maj. Allen did not consider an improvement at the mouth of the river a necessity, '91, 1940.

**Surveys.**

Examination between Camp Mojave and El Dorado Canyon, Ariz., ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Benyaure, '89, 2481.

**COLORADO RIVER, TEX. AND ARIZ.—Continued.****Surveys—Continued.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Benyaard, '91, 2974.

Examination for removal of raft at the mouth ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Allen, '91, 1936.

**COLUMBIA RIVER, CLARKS FORK.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 409.

ENGINEER IN CHARGE.

Capt. T. W. Symons. Report, '91, 3250.

ASSISTANT.

Wm. Cuthbert. Report, '91, 3254.

**Physical Characteristics.**

Description of the locality, '91, 3250.

**Plans.**

In 1891 Capt. Symons did not consider the river, from the international boundary line to the mouth of the Big Blackfoot River, worthy of improvement, '91, 3254.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '91, 3250.

**COLUMBIA RIVER, WASH.—SURVEY FOR SHIP CHANNEL FROM THE MOUTH OF THE WILLAMETTE TO VANCOUVER.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 421; '92, 395.

ENGINEER IN CHARGE.

Maj. T. H. Handbury, 1890. Report, '92, 2865, 2866.

**Physical Characteristics.**

Description of the locality, '92, 2866.

**Plans.**

By Maj. Handbury, 1891, for diversion of the current which passes behind Hayden Island into the main channel of the Columbia River so as to scour away the shoal now existing along the northern side of the island, which obstructs navigation for deep-sea vessels. This to be accomplished by closing the chute behind Hayden Island by a dam 3,000 feet in length; estimated cost, \$33,000, '92, 2868.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Handbury, '92, 2866.

**COLUMBIA RIVER AT THE DALLES, OREG.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 146.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '90, 3028.

BOARD OF ENGINEERS.

Convened at Portland, Oreg., August 21, 1888, to report upon project for overcoming obstructions to navigation in the Columbia River at the Dalles and Celilo Falls, and at Three and Ten Mile Rapids. Report, '90, 3030. (Colo. Mendall and Craighill and Maj. Post.)

ASSISTANT.

Lieut. E. Burr. Report, '90, 3044.

**COLUMBIA RIVER AT THE DALLES, OREG.—Continued.****Plans.**

By Board of Engineers, 1889, for removing boats from the river at the foot of Dalles Rapids and returning them to the river at the head of Celilo Falls by means of hydraulic lifts, one at each terminus, transporting them over the intermediate distance of 8 miles on a railway; also, improvement of Three-Mile Rapid; estimated cost, \$3,576,356, with an annual cost of \$80,000 for maintenance, '90, 3042.

**COLUMBIA RIVER (UPPER), WASH.—IMPROVEMENT OF.****Appropriations.**

1890..... \$70,000, '91, 3229.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 364; '90, 329; '91, 406; '92, 381.

**ENGINEERS IN CHARGE.**

Maj. W. A. Jones, 1888-'90. Report, '90, 3065, 3069.

Maj. T. H. Handbury, 1890-'91. Report, '90, 3066.

Capt. T. W. Symons, 1891-'— Reports, '91, 3223; '92, 2716.

**ASSISTANTS.**

J. C. Ensign. Report, '90, 3067.

J. G. Holcombe. Reports, '91, 3230; '92, 2718.

**Operations.**

1890-'91. Rock removal begun at Priest and Cabinet Rapids; 15 ringbolts and 6 buoys placed at Priest Rapids, '91, 3230.

1891-'92. 12,199 cubic yards rock blasted and removed at Cabinet Rapids; 1,894 cubic yards rock removed at Rock Island Rapids, '92, 2717.

**Physical Characteristics.**

Description of the locality, '90, 3069.

**Plans.**

By Maj. Jones, 1890, for opening to navigation the reach of river including Priest, Cabinet, and Rock Island Rapids, by means of auxiliary water power, at an estimated cost of \$138,000, with steam plant at an estimated cost of \$151,000, '90, 3074, 3075.

**Projects.**

By Capt. Symons, 1890, for improvement of the river at Rock Island, Cabinet, and Priest Rapids, by removal of rock and putting in at all locations, where they would be convenient, iron posts and ring bolts to which ascending boats could make fast their lines and wind themselves up over the rapids by means of their steam capstans; estimated cost, \$550,000, '91, 3224-25; '92, 2716.

**Surveys.**

Survey between Wallula and the British line ordered by act of August 11, 1888.

Made, 1889, under direction of Maj. Handbury, '89, 3066.

Survey from the head of Rock Island Rapids to the international boundary line.

Made, 1891, under direction of Capt. Symons, '91, 3232.

**MAPS.**

'92, 124, 125, 126, 127, 128, 129.

**COLUMBIA (UPPER) AND SNAKE RIVERS, OREG. AND WASH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 143.)

**Appropriations.**

1872-'87 .....	\$226,000
1888 .....	10,000, '88, 2189.
1890 .....	20,000, '90, 2983.
1892 .....	15,000, '92, 2715.

Total ..... 271,000

List of appropriations, '91, 3210.

8648—9

**COLUMBIA (UPPER) AND SNAKE RIVERS, OREG. AND WASH.—Continued.**

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '88, 305; '89, 363; '90, 322; '91, 405; '92, 330.

**ENGINEERS IN CHARGE.**

Maj. W. A. Jones, 1884-'90. Reports, '88, 2188; '89, 2584.

Capt. T. W. Symons, 1890-'—. Reports, '90, 2981; '91, 3210; '92, 2709, 2721.

**ASSISTANTS.**

W. H. Wood. Report, '92, 2712.

W. Cuthbert. Report, '92, 2723.

**Operations.**

History of operations, '89, 2585; '91, 3218.

1887-'88. No operations, '88, 2188.

1888-'89. 2,385 cubic yards rock removed, '89, 2584.

1889-'90. No operations, '90, 2982.

1890-'91. Construction of drill scow and preparation of plant, '91, 3211.

1891-'92. 293 cubic yards bed rock and boulders removed from channel between Riparia and Lewiston, '92, 2710.

**Physical Characteristics.**

Principal rapids between Celilo and Lewiston, with fall and slope, '91, 3214.

**Projects.**

Previous to the adoption of the project of 1877 efforts were directed to the removal of rocks at rapids on the Upper Columbia below the mouth of Snake River, '77, 1044; '80, 2294. The project of 1877 proposed the removal of rock at rapids so as to give channel depths of 5½ feet on the Columbia and 4½ feet on the Snake River, between Celilo on the former and Lewiston on the latter, a distance of 266 miles; estimated cost, \$132,000, '77, 1045; '82, 2040; '86, 359; '87, 2520.

By Capt. Symons, 1892, for dike construction at Wild Goose Island, Diamond Crossing, and Log Cabin Rapids, with removal of boulders; estimated cost, \$29,226, '92, 2715.

**Surveys.**

Survey of the Columbia River from the international boundary line to the head of Rock Island Rapids. Made, 1892, under direction of Capt. Symons, '92, 2721.

**COLUMBIA RIVER, OREG.—IMPROVEMENT OF THE CASCADES.**

(Continued from Vol. II, p. 144.)

**Appropriations.**

1876-'87 .....	\$1, 142, 500
1888 .....	300, 000, '88, 2184.
1890 .....	435, 000, '90, 3054.
1892 .....	326, 250, '92, 2822.

Total ..... 2, 203, 750

List of appropriations, '91, 3332; '92, 2822.

**Contracts.**

1889. F. G. Canel, for granite dimension stone, at \$1.35 per cubic yard, '89, 2544.

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '88, 301; '89, 359, 2557; '90, 326; '91, 414; '92, 388.

**BOARD OF ENGINEERS.**

Convened at Washington, D. C., February 24, 1888, by S. O. No. 7, to consider and report upon plan submitted by Capt. Powell for lock construction at the Cascades. Report, '88, 2170. (Col. Craighill, Lieut. Col. Gillespie, and Maj. Post.)

Convened at Portland, Oreg., August 24, by S. O. No. 28, to consider and report upon modifications in existing project proposed by Maj. Handbury. Report, '89, 2558. (Cols. Mendell and Craighill and Maj. Post.)

**ENGINEER IN CHARGE.**

Maj. T. H. Handbury, 1888-'—. Reports, '88, 2161; '89, 2543, 2551; '90, 3052; '91, 3328; '92, 2819.

**ASSISTANTS.**

Lieut. E. Burr. Reports, '88, 2165; '89, 2547; '90, 3054; '91, 3332.

Lieut. H. Taylor. Report, '92, 2823.

**COLUMBIA RIVER, OREG.—Continued.****Operations.**

- 1887-'88. 22,645 cubic yards material excavated from canal prism and caisson chamber; 12,365 cubic yards material used in grading; 130 feet of wing wall completed; excavation of lock chamber completed and concrete foundation laid; 1,321 cubic yards rubble used in paving slopes of upper canal entrance; 132 cubic yards stone quarried, '88, 2165-68.
- 1888-'89. 95,981 cubic yards bed rock and 15,698 cubic yards gravel excavated; 1,965 cubic yards of canal wall laid; 5,035 cubic yards of stone cut; 430 cubic yards bowlders quarried; plant construction, '89, 2547-50.
- 1889-'90. 6,038 cubic yards bed rock and 1,853 cubic yards bowlders excavated; 1,636 cubic yards concrete made and laid; pivot stones placed; construction of tail-bay walls begun; 335 cubic yards basalt stone quarried, '90, 3053.
- 1890-'91. 8,711 cubic yards of dimension stone, 12,520 cubic yards of dimension basalt, and 42,988 cubic feet of faced basalt cut; 1,544 cubic feet of stone laid in lock walls; 260 cubic yards stone laid in canal walls; 9,614 cubic yards of concrete made and placed; 2,085 cubic yards bed rock and 4,443 cubic yards gravel and sand excavated in preparation of lock masonry foundations; repairs to plant, '91, 3329, 3330.
- 1891-'92. 81,320 cubic feet dimension granite, basalt, basalt-face stone, and dimension stone cut; 604 cubic yards rubble quarried; 2,988 cubic yards stone laid in lock walls; 260 cubic yards stone laid in canal walls; 17,899 cubic yards concrete made and laid; 8,033 cubic yards material excavated and used for filling in behind walls; 21,214 cubic yards masonry used in construction of north abutment of lower lock and guard gates, and south wall of lock chamber, '92, 2824.

**Projects.**

- The project of 1887 proposed the improvement of the Cascades by a canal on the Oregon side about 7,200 feet long, with 2 locks 300 feet long and 50 feet wide, having a low-water depth of 8 feet over the miter sills; estimated cost, \$1,544,545, '77, 1047; '78, 1033.
- In 1878 the width of the locks was increased to 70 feet, '78, 1336; and the estimated cost of the work to \$1,753,867, '78, 1337; '80, 2301. Dimensions of canal, '79, 1849.
- The Board of Engineers of 1879 recommended the improvement of the low-water navigation through the reefs below the canal before the commencement of the construction of the lock masonry, '80, 2307, 2314; '81, 2571.
- In 1880 the project was modified by the Board of Engineers to provide for a navigation from low water to a stage 20 feet above; the construction of a single lock near the foot of the rapids 462 feet long, 90 feet wide, and with a lift of 24 feet, the gates to be 70 feet wide; canal prism about 3,000 feet long, 90 feet wide at the bottom, and 8 feet deep, '81, 327, 2564, 2576.
- In 1882, to provide for modifications of project and improvement of channel below canal, a revision of estimates was made, '81, 321.
- Amount appropriated from 1876 to 1882.... \$805,000.00 } '82, 2667.
- Amount required to complete project..... 1,655,397.31 }

Total ..... 2,460,397.31, '83, 2043.

- In 1885 it was proposed to make the widths of the gates equal to width of lock, '85, 2429. Increased width of 90 feet approved by Board of Engineers in 1888, '86, 1945.
- Total amount appropriated to 1886, \$1,142,500, '86, 1945. Amount required to complete project, \$1,100,000, '86, 359.
- In 1887 a revision of the estimates made the total estimated cost of the work \$2,992,500, '87, 2477, 2480.
- In 1888 the Board of Engineers, to which Capt. Powell's plan for lock construction at the Cascades was submitted, considered that the project for the construction of the Cascades Canal should at present be limited to providing for navigation up to a stage of 20 feet above low water, giving practically an all-year-round navigation, the location and dimensions of the lock to remain as proposed by the Board of 1880, and the upper guard gate of the lock to be omitted; width of canal above the lock to be increased to 250 feet, and below to 140 feet, '88, 2170-74.
- In 1888 iron was substituted for wood in the construction of the lock gates, '89, 2558.
- In 1890, after completing the details in the project for the lock and upper guard gates at the Cascades, Maj. Handbury estimated the cost of completing the project at \$1,745,516, '91, 3346, 3361.

**Surveys.****MAPS.**

'89, 2550.

**COLUMBIA RIVER (LOWER), OREG.—WILLAMETTE AND COLUMBIA RIVERS BELOW PORTLAND, EXCEPT COLUMBIA RIVER AT ITS MOUTH.**

(Continued from Vol. II, p. 146.)

**Appropriations.**

1866-'87, Lower Willamette and Columbia rivers.....	\$680, 365
1882-'87, gauging Lower Columbia and its tributaries.....	2, 500
1888.....	2, 500, '89, 2177.
1888.....	100, 000, '88, 2187.
1890.....	100, 000, '90, 3061.
1892.....	150, 000, '92, 2833.

Total ..... 1, 035, 365

List of appropriations, '88, 2575; '91, 3368.

**Commerce.**

List of steamers plying on the Upper and Lower Willamette, Columbia, and Clatsop rivers, '92, 2835.

**Contracts.**

1887. J. F. Steffen, for construction of snag boat, at \$19,560, '88, 2186.

1891. Hoffman & Bates, for construction of low-water brush and rock dam, at a total of \$27,274, '92, 2834.

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '88, 303, 304; '89, 361, 362; '90, 327, 329; '91, 416; '92, 389, 394.

**BOARD OF ENGINEERS.**

Convened at New York, October 14, 1891, to report upon project for a 25-foot channel from Portland, Oreg., to the sea. Report, '92, 2864. (Cols. Abbot, Comstock and Houston, and Lient. Col. Gillespie.)

**ENGINEERS IN CHARGE.**

Maj. T. H. Handbury, 1888-'—. Reports, '88, 2177; '89, 2565; '90, 3058, 3064; '91, 3362; '92, 2829.

Maj. W. A. Jones, 1886-'90. Reports, '88, 2185; '89, 2571.

**Operations.**

1887-'88. 20,000 cubic yards material dredged from Columbia River Bar, and 60 cubic yards rock blasted and removed, '88, 2185, 2186.

1888-'89. 31,130 cubic yards material dredged; Saint Helens Jetty extended 1,026 feet, '89, 2573.

1889-'90. 53,600 cubic yards material dredged, '90, 3064.

1890-'91. 33,800 cubic yards material dredged; 1,248 cords of brush and 1,250 tons of rock placed in dams at Martin and Burke sloughs; 1,157 linear feet of cross dike built, '91, 3364, 3365.

1891-'92. Break in dam at head of Martin Slough repaired; dam at Burke Slough strengthened; chute behind Swan Island in the Willamette River closed by a pile, brush, and stone dam; 21,860 cubic yards material dredged from Swan Island Bar. The following works were completed by the city of Portland: Between the foot of Swan Island and Saint Johns, 4,000 feet of diking; at Post-Office Bar, 6,300 feet of diking; in the Columbia River, 11,750 feet of diking built at Walker's Island; 15,000 feet of diking at Snag Island, in Cathlamet Bay; 97,500 cubic yards material dredged at foot of Swan Island and Saint Johns, from Post-Office Bar, and from bar at Walkers Island, '92, 2830, 2833.

**Physical Characteristics.**

Gauging lower river and principal tributaries, '88, 2177; '89, 2565; '90, 3064.

High waters of the Willamette, '90, 3059.

Description of the Lower Willamette and Columbia rivers, '92, 2852.

**Private and Corporate Work.**

20,000 cubic yards material dredged from Columbia River Bar by Portland Board of Trade, '88, 2185.

Diking and dredging by the city of Portland (*see* Operations), '92, 2832, 2833.

**Projects.**

History of operations and projects prior to 1880, '80, 2266.

From 1866, the date of the first appropriation, to 1876 the improvement consisted in dredging across Swan Island, Post-Office, and Saint Helens bars, and the bar at the mouth of the Willamette River, '80, 2267, 2270.

In 1877 a Board of Engineers recommended the permanent improvement of the channel from Portland, on the Willamette, to Columbia City, on the Columbia, so as to permit the passage of vessels drawing 20 feet or more. Improvements at the following localities: a dike closing the south channel of Willamette at Swan Island, the partial closing of Willamette Slough, dikes and revetment at the mouth of the Willamette to confine the current to the principal channel, and the construction of converging dikes on Saint Helens Bar. The amount appropriated previous to 1877 was \$240,365, '77, 1004. The Board estimated the cost of the above-named works at \$298,974, '77, 1019, 1025; '80, 2270.

**COLUMBIA RIVER (LOWER), OREG.—Continued.****Projects—Continued.**

- In 1879 a Board of Engineers recommended the substitution of constructions made of piles, fascines, and stone, in place of the brush and stone previously recommended, '80, 2253.
- In 1882, \$265,000 had been appropriated under this project, when it was modified to cover increased cost of work and additional constructions required, at an estimated cost of \$183,635, '82, 2644; '83, 1998; '84, 2216.
- In 1885 \$365,000 had been appropriated under the projects of 1877-'82, when it was further modified to cover the improvement of three shoal areas below Columbia City. Amount estimated for completion of project in 1885 was \$407,000, '85, 2377; '86, 357, 1940.
- In 1887 the estimated cost of completion was increased \$68,000, '87, 2516.
- In 1889 the cost of completion was increased to \$350,000 to provide for extension of the existing project to embrace the permanent improvement, by dredging and contraction works, of Walkers Island Bar, at a cost of \$15,000, and Post-Office Bar, at a cost of \$50,000, '89, 2575.
- By Maj. Handbury, 1891, to make and maintain a navigable channel from the city of Portland, Oreg., to the sea, bearing a low-water depth of 25 feet, by dredging through bars, closing chutes, construction of dikes and works of contraction and dredging; estimated cost, \$722,464, '92, 2860.

**Surveys.**

- Survey of the Lower Willamette and Columbia rivers with a view to securing 25 feet at low water from Portland to the mouth of the Columbia. Made, 1891, under direction of Maj. Handbury, '92, 2852.

**COLUMBIA RIVER, OREG.—IMPROVEMENT OF THE MOUTH OF.**

(Continued from Vol. II, p. 148.)

**Appropriations.**

1878-'87 .....	\$305, 000
1888 .....	500, 000, '88, 2158.
1890 .....	75, 000
1892 .....	475, 000, '90, 3016.
	350, 000, '92, 2811.

Total ..... 1,705, 000

List of appropriations, '91, 3318.

**Commerce.**

Tonnage out and in bound over Columbia River Bar for 1891-'92, '92, 2817.

Comparative statement of principal exports from 1883 to 1892, '92, 2818.

**Contracts.**

1889. P. Hinkle, for furnishing rock, at 64 cents per ton, '89, 2531. C. P. Church, for fascines, at \$2.74 per cord, and poles, at 24 cents each, '89, 2531. Paquet & Smith, for 4 barges, at \$5,870 each, '89, 2533.

1890. C. P. Church, for fascines, at \$2.84 per cord, and poles, at 23½ cents each, '90, 3014. J. E. Smith, for rock, at 63½ cents per ton, '91, 3319.

1891. R. Hoyt, for fascines, at \$2.70 per cord, and poles, at 22 cents each, '91, 3319.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 301; '89, 358; '90, 325; '91, 412; '92, 386.

**ENGINEER IN CHARGE.**

Maj. T. H. Handbury, 1888-'—. Reports, '88, 2155; '89, 2529; '90, 3011, 3025; '91, 3314; '92, 2806.

**ASSISTANT.**

G. B. Hegardt. Reports, '89, 2535; '90, 3017; '91, 3320; '92, 2811.

**Operations.**

1887-'88. Jetty tramway extended 2,500 feet; 1,400 linear feet of mattress built; 20,315 tons stone placed in jetty, '88, 2156.

1888-'89. 63,468 tons of rock placed in jetty; 4,176 linear feet of tramway built; 4,432 linear feet of mattress built; track and wharf construction and repairs to plant, '89, 2535-40.

1889-'90. Mattress foundation and tramway construction advanced 1.7 miles; construction of pile driver and repairs to plant; 120,354 tons rock placed in jetty, '90, 3012-14.

1890-'91. 4,128 tons of rock and 4,400 cords of fascines received and placed in the jetty; 1,700 linear feet of shore-trestle piling renewed; repairs to tracks, tramways, and plant, '91, 3314-17.



**COLUMBIA RIVER, OREG.—Continued.****Operations—Continued.**

1891-'92. Tramway extended 1,088 feet; 30,000 tons of rock dumped in widened portion of end of the jetty; 25,000 tons of rock used in securing the root of the jetty; 1,768 cords of fascines and 3,528 poles used in mattress construction, '92, 2808, 2809.

**Projects.**

By Board of Engineers, 1882, for a jetty, slightly convex to the north, extending from the shore near Fort Stevens in a northwesterly direction toward a point about 3 miles south of Cape Disappointment; the jetty to consist of random stone placed on a mattress foundation, and to be about 2,400 feet in length, with its top at low water, and a width not less than 5 feet; the outer 7,500 feet of the jetty to be faced with beton blocks of from 5 to 20 cubic yards each; estimated cost, \$3,710,000, '83, 2018; '87, 2470. Lieut. Col. Mendell, differing on some points from the majority of the Board, submits a minority report, '83, 2034. Congress authorizes commencement of improvements recommended by majority of Board, '84, 402.

In 1890 the cost of completion was reduced from \$2,423,000, in 1889, to \$525,000, '90, 3016; '91, 3319.

**Surveys.**

Survey of the mouth of the river. Made, 1891, under direction of Maj. Handbury, '91, 3325.

Surveys of the bar at the mouth of the river. Made, 1892, under direction of Maj. Handbury, '92, 2810.

**MAPS.**

'88, 2156; '89, 2534; '90, 3022; '91, 3325.

**COMBAHEE RIVER, S. C.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 158.

ENGINEER IN CHARGE.

Capt. F. V. Abbot. Report, '89, 1211.

**Physical Characteristics.**

Description of the locality, '89, 1211.

**Surveys.**

Examination to determine whether the breaking of Bull River into Combahee River, near the head of Bull River, will injure the navigation of Combahee River ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Abbot, '89, 1211.

**CONECUH RIVER, ALA. AND FLA.—(See ESCAMBIA AND CONECHO RIVERS.)****CONGAREE RIVER, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 150.)

**Appropriations.**

1886-'87 .....	\$7, 500
1888 .....	7, 500, '88, 945.
1890 .....	5, 000, '90, 1225.
1892 .....	5, 000, '92, 1218.

Total ..... 25, 000

List of appropriations, '89, 1194.

**Engineers.**

CHIEF OF ENGINEERS.

Reports '88, 133; '89, 156; '90, 139; '91, 174; '92, 173.

**CONGAREE RIVER, S. C.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'89. Report, '88, 943.

Capt. F. V. Abbot, 1889-'— . Reports, '89, 1193; '90, 1224; '91, 1464; '92, 1217.

**ASSISTANT.**

R. H. Whitford. Reports, '88, 946; '89, 1194; '90, 1226; '91, 1466; '92, 1218.

**Operations.**

1887-'88. 73 logs and stumps and 5 cords of small snags removed from the river channel, '88, 944.

1888-'89. 13 logs and stumps removed from the channel, '89, 1193.

1889-'90. 1,110 trees, logs, and snags removed from the channel; 450 trees and 8 cords brush cut from the banks, '90, 1226.

1890-'91. 1,374 snags and stumps cleared from the channel, and 913 trees and 58 cords of brush removed from the banks, '91, 1466.

1891-'92. 195 snags and logs and 11 cords of small snags cleared from the channel, '92, 1218.

**Projects.**

By Capt. Bixby, 1884, to secure a 4-foot navigation from its mouth to Grandby Landing, a distance of 47 miles, by the removal of snags, logs, rocks, and slight shoals, and in properly protecting caving banks; estimated cost, \$30,000, '85, 1144.

In 1887 the project was modified by providing for the clearing of obstructions to the natural depth of the river above Grandby, at a total estimated cost of \$54,500, '87, 1093; '91, 1465; '92, 1217.

**Surveys.****MAPS.**

'89, 1194.

**CONNEAUT HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 150.)

**Appropriations.**

1829-'80 .....	\$112, 629. 39
1892 .....	40, 000. 00

Total .....	152, 629. 39
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 276; '89, 328; '91, 373; '92, 352.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1885-'92. Reports, '88, 2015; '89, 2340.

Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2515.

**Operations.**

1887-'89. No operations, '88, 2015; '89, 2340.

**Plans.**

Maj. Overman reports in 1888, that unless the facilities of the harbor are increased further improvement is unnecessary, '88, 2015.

In 1889 Maj. Overman estimated that the repair and removal of piers and revetment and dredging to 16 feet depth through harbor entrance would cost \$115,000, '89, 2341.

In 1891 Maj. Overman recommended the construction of new piers and dredging between them to a depth of 17 feet, each pier to be about 2,000 feet long and to extend to the 17-foot curve in the lake; estimated cost, \$418,140, '92, 2519.

**Projects.**

By Capt. Maurice, 1829, for closing existing channel through sand bar at mouth of river by means of parallel piers of crib work; estimated cost, \$20,001.65, '80, 2166. Project completed in 1835, '80, 2167.

By Col. Cram, 1866, for repair of existing pier work, prolongation of west pier 350 feet, and dredging channel 115 feet wide and 12 feet deep; estimated cost, \$31,112, '80, 2169. Project completed in 1872, '80, 2170.

By Maj. Wilson, 1880, for restoration of pier and construction of pile work; estimated cost, \$35,090, '80, 2171; '86, 1873; '87, 2332.

**Surveys.**

Examination for deepening and widening the channel ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Overman, '89, 2340.

Survey of Conneaut Harbor. Made, 1891, under direction of Lieut. Col. Smith, '92, 2517.

**CONNECTICUT RIVER, above Hartford, Conn.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 151.)

**Appropriations.**

1829-'80 ..... \$100,000  
 List of appropriations, '88, 529; '92, 658.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 46; '89, 57; '90, 52; '91, 64; '92, 68.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886-'—. Reports, '88, 527; '89, 660; '90, 606; '91, 748; '92, 658.

**Operations.**

1887-'90. No operations; available funds insufficient to begin any general improvement, '88, 528; '89, 662; '90, 606; '91, 749; '92, 658.

**Physical Characteristics.**

Description of the river above Hartford, '88, 528.

**Projects.**

By Maj. Warren, 1871, for giving an increased depth to the channel by the construction of wing dams at five places between Hartford and Enfield Rapids, and by dredging; estimated cost, \$850,000, '71, 84, 757. No general project adopted, '87, 588; '88, 528; '91, 749; '92, 657.

**CONNECTICUT RIVER, below Hartford, Conn.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 151.)

**Appropriations.**

1827-'87 ..... \$381,380  
 1888 ..... 10,000, '88, 535.  
 1890 ..... 12,500, '90, 613.  
 1892 ..... 20,000, '92, 663.

Total ..... 423,880

List of appropriations, '88, 534; '91, 755; '92, 663.

**Contracts.**

1889. J. H. Fenner, for hire of dredging plant, at \$8.45 per hour, '89, 668.

1891. Hartford Dredging Company, for hire of dredging plant, at \$8.20 per hour, '91, 756.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 46; '89, 58; '90, 52; '91, 65; '92, 69.

**ENGINEER IN CHARGE.**

Lieut. Col. D. C. Houston, 1886-'—. Reports, '88, 530, 536; '89, 663; '90, 608, 614, 615; '91, 750; '92, 658.

**Operations.**

1887-'88. 1,080 tons granite delivered in west jetty; 46,604 cubic yards material dredged, '88, 533.

1888-'89. 98,511 cubic yards material dredged, '89, 666.

1889-'90. 63,441 cubic yards material dredged, '90, 611.

1890-'91. 37,763 cubic yards material dredged from the bars, '91, 754.

1891-'92. 58,058 cubic yards material dredged, '92, 661.

**Physical Characteristics.**

Description of the river; rise and fall of tides, '88, 530.

**Projects.**

The project of 1868 proposed the formation, by dredging, of channels 8 feet deep at low water and 100 feet wide at Hartford, Clay Banks, Pratts Ferry, Glastonbury, and Pistol Point, and a channel 200 feet wide and 8½ feet deep at Saybrook Bar; shore protection at Hartford and Weathersfield, and the removal of Chester Rock, '68, 66, 750, 776; '69, 409; '70, 447; '87, 591.

In 1873 jetties were proposed for the improvement of Saybrook Bar, with dredging to form a channel 9 feet deep and 400 feet wide, '73, 985; '87, 591.

By Lieut. Col. Warren, 1879, for the formation of a channel 200 feet wide and 9 feet deep between Hartford and Long Island Sound by mattress protection of banks; rectification of banks at Clay Banks and Glastonbury Bar; construction of wing dams at Hartford Bar, Pratts Ferry Bar, Press Barn Bar, Glastonbury Bar, and Dividend Bar; estimated cost, \$330,000, '80, 417, 418, 419, 420.

**CONNECTICUT RIVER, below Hartford, Conn.—Continued.****Projects—Continued.**

By Col. Houston, 1887, for completion of the jetties at the mouth of the river to a height of 5 feet above high water and a top width of 6 feet, widening the channel between the jetties to 400 feet, with a depth of 12 feet at mean low water, and annual dredging to maintain the channel from Hartford to Long Island Sound; estimated cost, \$90,000, '88, 582.

By Col. Houston, 1889, for raising the dike at Hartford to 15 feet above low water; estimated cost, \$50,000. Thus increasing the total cost for completion of the project to \$140,000, '89, 614, 615; '92, 659.

**CONTENTNEA CREEK, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 153.)

**Appropriations.**

1881-'87 .....	\$40,000
1888 .....	5,000, '88, 860.
1890 .....	7,000, '90, 1117.
1892 .....	7,000, '92, 1124.

Total ..... 59,000

**Commerce.**

Development of commerce due to improvement; reduction in transportation and insurance rates, '88, 862; '90, 1118.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 117; '89, 137; '90, 123; '91, 158; '92, 158.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 858; '89, 1048; '90, 1115; '91, 1351.

Maj. W. S. Stanton, 1892-'— Report, '92, 1123.

**ASSISTANTS.**

J. D. Whitford. Report, '88, 860.

R. Ransom. Reports, '89, 1050; '90, 1117; '91, 1353.

**Operations.**

1887-'88. 3,455 logs, snags, and stumps, 2,513 leaning trees, and 740 cords of brush and small snags removed from the channel, '88, 859.

1888-'89. 815 logs, stumps, and snags removed from the channel, and 905 trees removed along shore, '89, 1049.

1889-'90. No operations for lack of funds, '90, 1118.

1890-'91. 728 trees, 490 logs, and 245 cords of brush cleared from the banks, and 1,224 snags and logs and 132 cubic yards of mud removed from the channel, '91, 1352.

1891-'92. No operations, '92, 1124.

**Physical Characteristics.**

Water-gauge record for 1889, '91, 1352.

**Projects.**

By Capt. Phillips, 1881, for clearing the creek of obstructions and by dredging and diking so as to secure a depth of 3 feet during nine months of each year, from the mouth to the town of Stantonburg, a distance of about 70 miles; estimated cost, \$40,000, '81, 1010, 1012. Estimate increased to \$78,000, '85, 1060, 1062; '87, 1013; '91, 1351; '92, 1123.

**Surveys.****MAPS.**

'90, 1118; '92, Atlas, 23.

**COOSA RIVER, GA. AND ALA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 154.)

**Appropriations.**

1876-'87 .....	\$463,700
1888 .....	60,000, '88, 1180.
1890 .....	300,000, '90, 1644.
1892 .....	{ 130,000, '92, 1427.
	{ *100,000, '92, 1430.

Total ..... 1,063,700

List of appropriations, '88, 1179; '91, 1745.

\* Between Wetumpka, Ala., and the East Tennessee, Virginia and Georgia Railroad Bridge.

**COOSA RIVER, GA. AND ALA.—Continued.****Commerce.**

Commercial necessity for improvement; value of timber lands and coal and iron deposits; natural importance of the work, '88, 1181; '90, 1660, 1665, 1673.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 156; '89, 180, 185; '90, 162, 167; '91, 207, 208, 210; '92, 202.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1178.

Capt. F. M. Price, 1889-'— . Reports, '89, 1389, 2797; '90, 1640, 1658; '91, 1743, 1753; '92, 1424.

**ASSISTANTS.**

D. M. Andrews. Reports, '89, 1391; '90, 1643.

C. Firth. Reports, '90, 1674; '91, 1748; '92, 1428.

**Obstructions.**

Bridges obstructing navigation, '89, 2797.

**Operations.**

1887-'88. Construction of Lock and Dam No. 4 continued, '88, 1180.

1888-'89. 8,583 cubic yards material dredged; 306 cubic yards loose rock and 90 cubic yards solid rock removed; 1,828 cubic yards masonry and concrete laid; 3,305 cubic yards stone quarried, and 258 logs and snags removed, '89, 1392.

1889-'90. Lock No. 1 completed and opened to navigation; operations continued upon Locks Nos. 2 and 3; obstructions removed from the river between Locks 1 and 2, '90, 1643, 1644.

1890-'91. Lock No. 2 completed; operations continued upon Lock No. 3; work begun upon Lock No. 4; excavation of channel through Lonnergan Reef in progress, '91, 1746.

1891-'92. Upper section, between Rome and the East Tennessee, Virginia and Georgia Railroad Bridge: Repairs to dam at Lock No. 3, and guide crib above the lock filled with stone; 222 linear feet of stone dam built at foot of Wood Island; 1,096 cubic yards rock removed from the channel at Lonnergan Reef, and timber guide cribs built; dam abutment, cofferdam, and lock house completed at Lock No. 4, '92, 1425, 1426. Lower section, between Wetumpka, Ala., and the East Tennessee, Virginia and Georgia Railroad Bridge: Erection and preparation of plant and commencement of rock excavation in construction of lock at Wetumpka, '92, 1428.

**Physical Characteristics.**

Character of banks and slope of river bed, '89, 1390. General description of the river, '90, 1659-66, 1669; '91, 1744.

**Plans.**

By Capt. Price, 1889, for improvement of the Coosa River from the rapids at Wetumpka to connect with the improvements already completed on said river above the Ten Islands, giving a complete system of slack-water navigation with a minimum channel depth of 6 feet; this to be accomplished by the removal of rock and the construction of 27 locks and dams, the locks to be 52 feet wide and 320 feet between miter sills; estimated cost, \$6,074,913, '90, 1670, 1672, 1677, 1686.

**Projects.**

For prior projects see '90, 1667, 1668.

By Capt. King, 1877, for improvement of river from Greensport to Selma, Rome and Dalton Railroad Bridge by excavation of a channel 80 feet wide and 4 feet deep at extreme low water, and by a system of locks and dams around Ten Island Shoals; estimated cost, \$560,663, '77, 598; '81, 1871; '87, 1281.

The estimates of the cost of this work have been increased from time to time on account of inadequate appropriations and modifications of the original project, consisting mainly of the adoption of a better quality of work for the locks, cut-stone masonry being substituted for wooden cribs. In 1889 the estimate for completion was \$225,000, making a total estimated cost of \$748,700, '89, 1390, 1391.

In 1890 the estimate for completion of the improvement between Rome and the East Tennessee, Virginia and Georgia Railroad Bridge, exclusive of the appropriation of 1890, was \$971,840, '90, 1641, 1642, 1644.

The act of September 19, 1890, making an aggregate appropriation of \$300,000 for the improvement of the Coosa River, fixed the dimensions of the locks at 40 feet width, with 210 feet between miter sills; estimated cost for completion of 31 locks and dams, \$6,033,207, '91, 1744, 1747, 1752.

**Surveys.**

Of Coosa River from rapids at Wetumpka to Ten Islands ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Price, '90, 1658, 1665.

**COOSA RIVER, GA. AND ALA.—Continued.****Surveys—Continued.****MAPS.**

'90, 1644; '91, 1752; '92, Atlas, 68, 69.

**COOSAWATTEE RIVER, GA.—(See OOSTENAULA AND COOSAWATTEE RIVERS.)****COOS BAY, OREG.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 155.)

**Appropriations.**

1879-'87 .....	\$163, 750
1888 .....	50, 000, '88, 2143.
1890 .....	125, 000, '90, 2933.
1892 .....	210, 000, '92, 2674.

Total ..... 548, 750

List of appropriations, '91, 3155.

**Commerce.**

Lumber and coal interests, '90, 2931, 2932. Tabular record of exports from Coos Bay from 1879 to 1891, '91, 3167.

**Contracts.**

1889. P. O'Neil, for stone, at \$1.39 per cubic yard, '89, 2508.  
1892. P. O'Neil, for brush fascines, at \$2 per cord, '92, 2670.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 297; '89, 354; '90, 318; '91, 401, 410; '92, 376.

**BOARD OF ENGINEERS.**

Convened at Portland, Oreg., November 18, 1888, by S. O. No. 58, to examine and report upon project for improvement of Coos Bay. Reports, '89, 2510; '90, 2936. (Col. Mendell and Majs. Jones and Handbury.)

**ENGINEERS IN CHARGE.**

Capt. W. Young, 1888-'90. Reports, '88, 2141; '89, 2507.

Capt. T. W. Symons, 1890-'—. Reports, '90, 2929; '91, 3154, 3283; '92, 2669.

**ASSISTANTS.**

R. S. Littlefield. Report, '90, 2933.

J. S. Polhemus. Reports, '91, 3163; '92, 2674.

J. R. Savage. Report, '92, 2672.

**Operations.**

History of the work, '90, 2937; '91, 3160.

1887-'88. 7,000 cubic yards of earth removed in quarry sluicing, '88, 2142.

1888-'89. 3,314 cubic yards stone placed in foundation of jetty extension, '89, 2508.

1889-'90. 38,845 cubic yards stone placed in extension of the jetty, '90, 2930-33.

1890-'91. 1,841 cubic yards rock deposited in the jetty; 1,600 linear feet of stone trestle built, and plant constructed for commencement of north jetty work, '91, 3164.

1891-'92. 3,200 linear feet of jetty tramway built; 23,923 tons rock placed in the jetty; 4,336 linear feet of mattress work placed, '92, 2671.

**Physical Characteristics.**

Description of the locality, '90, 2930, 2938, 2944.

Tidal capacity of Coos Bay, '90, 2940.

Movement of sand, '90, 2941; '91, 3158.

**Plans.**

By Capt. Symons, 1891, for improvement of the upper harbor at Coos Bay by dredging a channel through the shoal at the lower end of Marshfield and one above the coal bunkers in Isthmus Slough to a depth of 10 feet at low water and a bottom width of 100 feet; estimated cost, including the construction of dredge and equipment, \$27,390, '91, 3285.

**COOS BAY, OREG.—Continued.****Projects.**

By Maj. Gillespie, 1879, for the construction of a half-tide jetty, from near Fossil Point, in a curved line toward Coos Head, to open and maintain a deeper and more direct channel across the outer bar; estimated cost, \$600,000, '80, 2323; '83, 2055; '87, 2460; '88, 2142.

By Board of Engineers, 1889, for improvement of the bay, securing a low-water depth of 20 feet through the bar at its entrance by construction of two parallel jetties of riprap stone upon mattress foundation, crossing the bar at a distance apart of 1,500 feet; the north jetty to be 9,600 feet in length; the south jetty to be 4,200 feet in length; both jetties to be brought to high-water level, and to have a top width of 10 feet; estimated cost, \$2,466,412, '90, 2941, 2942.

**Surveys.**

Surveys of Lower Coos Bay. Made, 1889, under direction of Capt. Young, '90, 2948.

Survey of Coos Bay for improvement of the upper harbor. Made, 1891, under direction of Capt. Symons, '91, 3284.

**MAPS.**

'91, 3163.

**COQUILLE RIVER, OREG.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 156.)

**Appropriations.**

1880-'87 .....	\$50,000
1888 .....	25,000, '88, 2140.
1890 .....	30,000, '90, 2927.
1892 .....	25,000, '92, 2665.

Total ..... 130,000

List of appropriations, '91, 3146.

**Contracts.**

1891. W. R. Panter, for piles, at 5 cents per linear foot. E. Fahy, for lease of quarry, at \$100 per annum. Capt. Parker, for furnishing scows and steamboat, and towing rock from the quarry to the wharf, at \$1 per cubic yard, '91, 3147.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 296; '89, 353; '90, 317; '91, 399; '92, 375.

**ENGINEERS IN CHARGE.**

Capt. W. Young, 1888-'90. Reports, '88, 2137; '89, 2503.

Capt. T. W. Symons, 1890-'—. Reports, '90, 2924; '91, 3146; '92, 2662.

**ASSISTANT.**

R. S. Littlefield. Report, '92, 2667.

**Operations.**

1887-'88. Jetty extended 300 linear feet by 14,235 linear feet of piling and 3,384 cubic yards of stone, '88, 2138.

1888-'89. 4,000 cubic yards stone quarried and placed in jetty, and 1,944 feet of tramway built, '89, 2504.

1889-'90. Rock removal and snagging, '90, 2925.

1890-'91. 327 snags and 69 scow loads of drift cleared from the river; plant prepared for extension of north jetty, '91, 3147.

1891-'92. 1,500 cubic yards stone placed in the jetty; erection of buildings and construction of plant, '92, 2663.

**Projects.**

By Maj. Wilson, 1878, for improvement of the bar at the mouth, so as to give a channel 10 feet deep at mean low water, by construction of training walls; estimated cost, \$164,200, '79, 1808, 1810; '81, 2599.

In 1891 Capt. Symons estimated the cost of completing the project at \$130,000, including the extension of the south jetty 700 feet farther than at present built, and the completion of the north jetty to an equal length, making the total revised cost of the project \$228,000, '91, 3148.

In 1892 Capt. Symons estimated the cost of completing the project at \$180,718, '92, 2665.

**Surveys.****MAPS.**

'91, 3151.

**CORSICA SHOAL, SAINT CLAIR RIVER, MICH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 363.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1890. Report, '91, 2820, 2821.

**Physical Characteristics.**

Description of the locality, '91, 2821.

**Plans.**

By Col. Poe, 1891, for excavation of a channel 21 feet deep through Corsica Shoal near the entrance to the Saint Clair River, at an estimated cost of \$410,666, '91, 2822.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Col. Poe, '91, 2820.

**CORSICA CREEK, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 157.)

**Appropriations.**

1882-'87 ..... \$20,000

1888 ..... 10,000, '88, 747.

Total ..... 30,000

List of appropriations, '90, 938.

**Contracts.**

1889. Baltimore Dredging Company, for dredging, at 12½ cents per cubic yard, '89, 900.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 92; '89, 109; '90, 100.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1884-'—. Reports, '88, 747; '89, 899; '90, 937.

**Operations.**

1887-'90. No operations for lack of funds, '88, 747; '89, 900; '90, 937.

**Projects.**

By Lieut. Col. Craighill, 1882, for the formation of a dredged channel from Hoopers Landing to Centerville 100 feet wide and 8 feet deep at mean low water; also a turning basin at Centerville 200 by 300 feet; estimated cost, \$30,000, '82, 842

**COS COB (MIAMUS) RIVER, CONN.—SURVEY OF.****Appropriations.**

1892 ..... \$7,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 81.

ENGINEER IN CHARGE.

Col. D. C. Houston. Report, '91, 852, 855.

**Physical Characteristics.**

Description of the locality, '91, 854.

**Plans.**

By Col. Houston, 1891, for a low-water channel, from the mouth of the river up to the railroad bridge, 150 feet wide and 8 feet deep; estimated cost, \$36,000, '91, 855.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Col. Houston, '91, 855.



**COWLES CREEK, OHIO.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 328.

ENGINEER IN CHARGE.

Maj. L. C. Overman, 1888. Report, '89, 2335.

**Physical Characteristics.**

Description of the locality, '89, 2335.

**Plans.**

In 1889 Maj. Overman did not consider that the commerce of the creek, present or prospective, warranted an improvement at this locality, '89, 2336.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Overman, '89, 2335.

**COWLITZ RIVER, WASH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 158.)

**Appropriations.**

1880-'87 .....	\$8,000
1888.....	3,000, '88, 2190.
1890.....	8,000, '90, 3064.
1892.....	3,000, '92, 2838.

Total ..... 22,000

List of appropriations, '91, 3371.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 306; '89, 364; '90, 329; '91, 418; '92, 392.

ENGINEERS IN CHARGE.

Maj. W. A. Jones, 1885-'90. Reports, '88, 2190; '89, 2589.

Maj. T. H. Handbury, 1890-'—. Reports, '90, 3063; '91, 3370; '92, 2837.

**Operations.**

1887-'88. No operations, '88, 2190.

1888-'89. 280 snags, 9 log jams, rock and gravel cleared from the channel; 250 linear feet of wing dams built, '89, 2590.

1889-'90. No operations, '90, 3063.

1890-'91. 1,200 cubic yards of gravel and 156 logs, snags, and trees removed from the channel between the mouth and Toledo, '91, 3370.

1891-'92. 50 snags cleared from the channel, and 400 linear feet of wing dam built at Toutle River Pass, '92, 2838.

**Projects.**

By Maj. Gillespie, 1879, for improvement of the river from the mouth to Cowlitz Landing by removing snags and scraping bars; estimated cost, \$5,000 for the first year, with an annual expenditure thereafter of \$2,000, '81, 2603; '86, 1952; '91, 3371.

**CRANES CREEK, VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 146.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1891. Report, '91, 1289.

**Physical Characteristics.**

Description of the locality, '91, 1289.

**Plans.**

In 1891 Lieut. Col. Hains did not consider the locality worthy of improvement, '91, 1289.

**Surveys.**

Examination made, 1891, under direction of Lieut. Col. Hains, '91, 1289.

**CRANE AND WATERS RIVERS, MASS.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 44; '90, 38.

**ENGINEER IN CHARGE.**

Lieut. Col. S. M. Mansfield, 1888. Report, '90, 517.

**ASSISTANT.**

T. T. Hunter Harwood. Report, '90, 519.

**Physical Characteristics.**

Description of the locality, '90, 517.

**Plans.**

By Lieut. Col. Mansfield, 1889, for improvement of Waters River by enlarging the existing low-water channel to a width of 100 feet and a depth of 8 feet at mean low water from deep water of Essex Branch to the wharves at the head of navigation; estimated cost, \$14,000; also for improvement of Crane River by excavation of a channel 2,850 feet long, 100 feet wide, and 8 feet deep at mean low water; estimated cost, \$30,000, '90, 518, 519.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Mansfield, '90, 517.

**CREELS BAY, TOTTEN BAY, AND MINNEWAUKEN SHOALS, IN DEVILS LAKE, N. DAK.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 274, 2223.

**ENGINEER IN CHARGE.**

Maj. W. A. Jones, 1891. Report, '91, 2223.

**Plans.**

In 1891 Maj. Jones did not consider the above localities worthy of improvement, '91, 2223.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Jones, '91, 2223.

**CROOKED RIVER, WASH.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 420.

**ENGINEER IN CHARGE.**

Maj. T. H. Handbury, 1890. Report, '91, 3378.

**Physical Characteristics.**

Description of the locality, '91, 3378.

**Plans.**

In 1890 Maj. Handbury did not consider the locality worthy of improvement, '91, 3379.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Handbury, '91, 3378.

**CRYSTAL RIVER, FLA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 1355.

**ENGINEER IN CHARGE.**

Capt. W. M. Black, 1888. Report, '89, 1355.

**ASSISTANT.**

Lieut. D. D. Gaillard. Report, '89, 1356.

**CRYSTAL RIVER, FLA.—Continued.****Physical Characteristics.**

Description of the locality, '89, 1355.

**Plans.**

In 1889 Capt. Black considered the available channel depth sufficient for existing commercial requirements, '89, 1355.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Black, '89, 1355.

**CUMBERLAND RIVER, above Nashville.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 161.)

**Appropriations.**

1876-'87 .....	\$421,000
1888 .....	200,000, '88, 1618.
1890 .....	250,000, '90, 2139.
1892 .....	250,000, '92, 1939.

Total ..... 1,121,000

List of appropriations, '89, 1840.

**Commerce.**

Present and prospective benefits to commerce, '90, 2138.

**Contracts.**

1888. Holmes & Wilk, for lock and dam construction, at a total of \$57,080, '89, 1844.  
P. L. Hedrick, for lock-keeper's house, at \$2,937.80, '89, 1844.

1891. F. Hartney, for timber and stone dike construction, at a total of \$16,979, '91, 2275. H. F. Holmes, for completion of masonry at Lock No. 1, at a total of \$35,490, '91, 2276. Rich & Holmes, for construction of cofferdam, excavation of lock pit, and completion of masonry of Lock No. 2, at a total of \$163,550, '91, 2277.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 211; '89, 246; '90, 222; '91, 283; '92, 270.

**BOARD OF ENGINEERS.**

Convened at Chattanooga, March 30, 1887, by S. O. No. 43, to examine and report upon Lieut. Col. Barlow's project for a lock and dam at Lower Nashville Island. Report, '88, 1622. (Lieut. Cols. Poe and Merrill and Lieut. Waterman.)

Report by Maj. King, '88, 1625.

Convened at Nashville, Tenn., November 16, 1889, by S. O. No. 68, to examine and report upon proposed dam at Lock No. 1, Cumberland River. Report, '90, 2144. (Col. Poe and Lieut. Cols. Merrill and Barlow.)

**ENGINEERS IN CHARGE.**

Lieut. Col. J. W. Barlow, 1886-'92. Reports, '88, 1614, 1618; '89, 1840; '90, 2136; '91, 2270.

Lieut. Col. H. M. Robert, 1892-'— Report, '92, 1931.

**Operations.**

1887-'88. 150 cubic yards rock and gravel removed; 215 cubic yards riprap stone quarried; 721 cubic yards riprap dam built; 602 snags removed from channel, and 926 trees from the banks, '88, 1615.

1888-'89. 500 cubic yards riprap dams built; 81 cubic yards brush and stone bank protection placed; 193 snags removed from channel, and 753 trees from the banks; 100 linear feet of cofferdam built, and 865 cubic yards rock excavated from lock pit, '89, 1841, 1842.

1889-'90. Construction of Lock No. 1 continued; cofferdam completed; 5,204 cubic yards rock excavated from lock pit; 1,840 cubic yards stone quarried, '90, 2137.

1890-'91. 1,700 cubic yards of earth and 10,855 cubic yards of rock excavated from lock pit at Lock and Dam No. 1; 842 cubic yards of masonry quarried, '91, 2271. 3,000 cubic yards of earth excavated for lock site at Lock and Dam No. 2, and construction of cofferdam begun, '91, 2272. 1,011 snags and 1,708 bowlders removed from the channel, and 7,795 trees cleared from the banks, '91, 2273.

1891-'92. 300 snags removed from the channel, and 1,643 overhanging trees cleared from the banks, '92, 1935. Construction of Lock and Dam Nos. 1 and 2 continued, '92, 1936.

**Physical Characteristics.**

Table of distances, with fall of water on shoals, and average depth in pools on the Lower Cumberland River from Lock No. 1; upper river improvement to the Ohio River, '90, 2140.

**CUMBERLAND RIVER, above Nashville—Continued.****Projects.**

- By Maj. Weitzel, 1872, for the improvement of the river from the Falls of the Cumberland to Nashville, 372 miles, by excavation of ledges, sand and gravel bars, concentration of water by wing dams, removal of snags and bowlders, and the restriction of tributaries to determined channels; estimated cost, \$258,864, '71, 470, 478; '72, 471; '77, 594.
- By Maj. McFarland, 1875, for the improvement of Smiths Shoals by wing dams, so as to give descending coal boats a depth of 4 feet during mean high water, '75, 1, 795, 796.
- In 1881 Maj. King proposed the improvement of the river between Jellico and Cumberland Ford, a distance of 110 miles, by removal of snags, trees, and similar obstructions; estimated cost, \$55,000, '81, 1853; '87, 1736.
- By Maj. King, 1884, for improvement of the river from Nashville to the head of Smiths Shoals, giving a slack-water navigation by the construction of 23 locks between Nashville and Point Burnside, and 7 locks at Smiths Shoals, giving a depth of 5 feet on the lower miter sills; estimated cost, \$4,077,922, '84, 1663, 1665; '87, 1761.
- Dimensions of locks, as fixed by Board of Engineers, 280 feet long and 52 feet wide, '87, 1760.
- In 1891 locks of larger dimensions than those contemplated in the original project and estimates having been recommended by the Board of Engineers, the estimate was revised, making the cost of the 23 locks and dams between Nashville and Point Burnside \$5,750,000, and to continue the improvement to the head of Smiths Shoals, with 7 additional locks and dams, was estimated to cost \$1,750,000, making the total estimated cost of the revised project \$7,500,000, '91, 2270; '92, 1:38.

**CUMBERLAND RIVER, below Nashville.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 163.)

**Appropriations.**

1832-'87 .....	\$410, 000
1888 .....	10, 000, '88, 1614.
1890 .....	40, 000, '90, 2136.
1892 .....	40, 000, '92, 1931.

Total ..... 500, 000

List of appropriations, '92, 1929.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 210, 1627; '89, 245, 248; '90, 221, 223; '91, 282; '92, 270.

**BOARD OF ENGINEERS.**

Convened at Chattanooga, June 16, 1888, by S. O. No. 22, to report upon a plan for the improvement of the mouth of the Cumberland. Report, '88, 1628. (Lieut. Cols. Merrill and Barlow, Maj. Mackenzie, and Lieut. Waterman.)

**ENGINEERS IN CHARGE.**

Lieut. Col. J. W. Barlow, 1886-'92. Reports, '88, 1611, 1626, 1631; '89, 1837; '90, 2133, 2151, 2152; '91, 2268.

Col. H. M. Robert, 1892-'—. Report.

**ASSISTANTS.**

C. A. Locke. Report, '90, 2158.

B. B. Smith. Report, '90, 2159.

**Operations.**

1887-'88. 5,780 cubic yards riprap dam built; 4,800 cubic yards riprap stone quarried; 517 snags removed from the channel and 1,065 from the banks, '88, 1612.

1888-'89. No operations, '89, 1839.

1889-'90. 116 snags and stumps and 10 cubic yards solid rock removed from channel; 330 cubic yards stone quarried, and repairs to dams, '90, 2134.

1890-'91. 40 cubic yards sand and gravel removed at Lower Gatlin Shoal; 748 cubic yards of rock removed from longitudinal dam, and 923 cubic yards of new spur riprap dam built; 22 snags and 550 overhanging trees cleared from channel and banks, '91, 2268.

1891-'92. 1,210 snags, 61 cubic yards rock, 1,050 cubic yards gravel, and 15 tons of wreckage removed from the channel, and 1,139 trees cleared from the banks; reconstruction of spur dams at Cumberland Island, '92, 1929.

**CUMBERLAND RIVER, below Nashville—Continued.****Physical Characteristics.**

Description of the Lower Cumberland, '90, 2154.

Table of current velocities on the Lower Cumberland, '90, 2161.

**Plans.**

By Lieut. Col. Barlow, 1889, for improvement of the Cumberland River between Nashville and Big Eddy, a distance of 144 miles, by the construction of 7 locks and dams; estimated cost, \$1,783,350, '90, 2157.

**Projects.**

From 1832 to 1871, inclusive, \$185,000 was appropriated for this part of the river, '74, i, 578.

By Maj. Weitzel, 1872, for improvement of the Cumberland River below Nashville, so as to give a low-water depth of 3 feet, by excavation of ledges, sand and gravel bars, removal of snags and bowlders, concentration of water by wing-dam construction, and restriction of tributaries to determined channels; estimated cost, \$248,821, '71, 480; '72, 462. Total estimated cost of improvement increased in 1884 to \$348,000, '84, 1646; '87, 1759.

In 1888 the Board of Engineers provided for the improvement of the Cumberland at its mouth, closing the left channel around the tow head by a pile and brush dam 20 feet wide and rising to low-water level, capped by crib work built up to the 8-foot stage of the river; estimated cost, \$129,600. (Lieut. Cols. Merrill and Barlow, Maj. Mackenzie, and Lieut. Waterman.) This, together with \$20,000 proposed by Lieut. Col. Barlow, 1888, for snagging at Gatlin Shoals, increases the total estimate for the improvement of the Lower Cumberland to \$497,600, '88, 1613, 1614, 1630, 1631; '90, 2158.

**Surveys.**

Survey of the Lower Cumberland, with a view to slack-water navigation, ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Barlow, '90, 2152.

**MAPS.**

'88, 1631; '90, 2156.

**CUMBERLAND RIVER, KY., South Fork of.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 164.)

**Appropriations.**

1882-'87 ..... \$12,000

List of appropriations, '89, 1846.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 211; '89, 274; '90, 222; '91, 285; '92, 273.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. W. Barlow, 1886-'92. Reports, '88, 1633; '89, 1846; '90, 2148; '91, 2286.

Lieut. Col. H. M. Robert, 1892-'—. Report, '92, 1943.

**Operations.**

1887-'88. 607 cubic yards riprap quarried, and 2,000 cubic yards of spur dam built, '88, 1633.

1888-'92. No operations for lack of funds, '89, 1846; '90, 2148; '91, 2286; '92, 1943.

**Projects.**

By Maj. King, 1881, for improvement of about 44 miles of river below Devils Jump, by removal of gravel bars and bowlders, excavating channel through rocky reefs, and construction of wing dams, so as to secure safe navigation at stages of the river when at least 3 feet above low water; estimated cost, \$62,803, '81, 1897, 1898; '86, 270; '87, 235; '90, 2149.

**CUMBERLAND SOUND, GA. AND FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 164.)

**Appropriations.**

1880-'87 ..... \$367,500

1888 ..... 112,500, '88, 1053.

1890 ..... 112,500, '90, 1426.

1892 ..... 170,000, '92, 1290.

Total ..... 762,500

List of appropriations, '88, 1053; '91, 1562.

**CUMBERLAND SOUND, GA. AND FLA.—Continued.****Commerce.**

Amount of, dependent upon water transportation through Cumberland Sound, '90, 1424; '91, 1561.

**Contracts.**

1888. Anson M. Bangs, for jetty construction, stone at \$3.27 and shells at \$1.27 per cubic yard, '89, 1276.

1891. J. F. Gaynor, for brush mattress at 97 cents and log and brush mattress at 99 cents per square yard, and stone at \$3.49 per cubic yard, '91, 1563.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 142; '89, 163; '90, 146; '91, 184; '92, 180.

**BOARD OF ENGINEERS.**

Convened at Washington, November 10, 1888, by S. O. No. 50, to report upon a project for the improvement of Cumberland Sound. Report, '89, 1281. (Lieut. Cola. Gillespie and King and Maj. Post.)

**ENGINEER IN CHARGE.**

Lieut. O. M. Carter, 1888.—. Reports, '88, 1050; '89, 1273, 1280; '90, 1422; '91, 1559, 1565; '92, 1286.

**ASSISTANTS.**

W. R. Curtis. Report, '88, 1054.

M. P. Paret. Reports, '89, 1276; '90, 1426.

**Operations.**

1887-'88. 37,725 square yards wattling and 11,821 cubic yards stone placed in jetty, '88, 1052.

1888-'89. 10,513 cubic yards stone and 1,253 cubic yards shell placed in the jetty, '89, 1277.

1889-'90. 18,060 cubic yards stone and 818 cubic yards shell placed in the jetty, '90, 1426.

1890-'91. 2,770 square yards of brush mattress and 382 cubic yards of stone used in extending the foundation course of the north jetty 267 feet, '91, 1561.

1891-'92. 58,759 square yards brush mattress and 11,429 cubic yards stone used in extension of foundation course of north jetty 6,177 feet, '92, 1288.

**Physical Characteristics.**

Tidal observations, '91, 1576.

Direction and velocity of currents, '91, 1581, 1582.

Ebb and flood volumes, '91, 1591.

Borings, '91, 1596.

**Projects.**

By Lieut. Col. Gillmore, 1879, for two low jetties of riprap stone resting upon a foundation mattresses of logs and brush, starting from the shores on opposite sides of the entrance and extending seaward across the bar, with outer ends parallel to each other and from 3,000 to 3,500 feet apart, designed to give a low-water channel 20 to 21 feet deep; estimated cost, \$2,071,023, '79, 793; '80, 965; '86, 189; '87, 1191; '91, 1566, 1573; '92, 1286.

In 1891 the Board of Engineers fixed the width between the outer ends of the jetties at 3,900 feet, and made the elevation of the south jetty to high water throughout its entire length provisional upon failure to secure sufficient depth with lower jetties, '91, 1601.

**Surveys.****MAPS.**

'88, 1052; '89, 1276; '91, 1561; '92, Atlas, 60.

**CURRENT RIVER, MO.—EXAMINATION OF.**

(Continued from Vol. II, p. 165.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 257.

**ENGINEER IN CHARGE.**

Capt. H. S. Taber, 1890. Report, '91, 2065.

**ASSISTANT.**

J. R. Van Frank. Report, '91, 2067.

**Physical Characteristics.**

Description of the locality, '91, 2065.

**CURRENT RIVER, MO.—Continued.****Plans.**

By Capt. Taber, 1890, for improvement from Van Buren to the mouth by construction and operation of snag boat and erection of wing dams; estimated cost, \$10,000, '91, 2066.

**Surveys.**

Examination made, 1890, under direction of Capt. Taber, '91, 2065.

**CURRITUCK SOUND, COANJOK BAY, AND NORTH RIVER BAR, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 166.)

**Appropriations.**

1878-'87 .....	\$135,000
1888 .....	7,500, '88, 772.
1890 .....	10,000, '92, 1095.
1892 .....	9,000, '92, 1095.

Total ..... 161,500

List of appropriations, '92, 1095.

**Commerce.**

Traffic passing through Coanjok Bay, etc., for 1889 and 1890, '89, 963; '90, 1029.

**Contracts.**

1889. P. S. Ross, for dredging, at 28½ cents per cubic yard, '90, 1027.

1891. C. T. Caler, for dredging, at 24½ cents per cubic yard, '92, 1095.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 102; '89, 119; '90, 108; '91, 152; '92, 152.

**ENGINEERS IN CHARGE.**

Col. W. P. Craighill, 1888-'89. Report, '88, 770.

Lieut. G. J. Fiebeger, 1889-'92. Reports, '89, 961; '90, 1027; '91, 1305.

Lieut. E. Burr, 1892-'— . Report, '92, 1095.

**Operations.**

1887-'88. Dredging on North River Bar completed, '88, 770.

1888-'89. No operations, '89, 961.

1889-'90. 21,494 cubic yards material dredged and 71 logs removed from the channel, '90, 1027.

1890-'91. No operations, '91, 1305.

1891-'92. 32,308 cubic yards material dredged, '92, 1095.

**Projects.**

By Capt. Phillips, 1878, to secure through Currituck Sound, by dredging, a channel 80 feet wide and 9 feet deep at ordinary winter stage of water; estimated cost, \$90,000, '79, 693; '80, 827.

By Capt. Phillips, 1880, for improvement of Coanjok Bay by dredging channel same dimensions as above, to be protected on western side by an oyster-shell dike 9,200 feet in length; estimated cost, \$50,213.95, '81, 1000.

By Capt. Hinman, 1886, for improvement of North River Bar by excavation of a channel 7,150 feet long, 150 feet wide, and 9.4 feet deep at ordinary low water; also, construction of two range lights to mark channel; estimated cost, \$55,122, '85, 86, 155.

**Surveys.****MAPS.**

'89, 962.

**CYPRESS BAYOU, TEX. AND LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 167.)

**Appropriations.**

1872-'87 .....	\$117,000
1890 .....	10,000, '91, 2022.
1892 .....	2,000, '92, 1671.

Total ..... 129,000

**CYPRESS BAYOU, TEX. AND LA.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 177; '89, 208; '90, 195; '91, 248; '92, 240.

**ENGINEER IN CHARGE.**

Capt. J. H. Willard, 1886'— Reports, '88, 1343; '89, 1595; '90, 1826, 1914; '91, 2021; '92, 1668.

**Operations.**

1887-'88. 102,704 cubic yards earth, etc., and 2,150 logs and snags removed from the channel; 825 linear feet brush dams built, and 560 trees removed from the banks, '88, 1344.

1888-'89. No operations, '89, 1596.

1889-'90. 26,359 cubic yards material dredged from the channel; 4,200 trees cut; 210 stumps and trees removed from channel, '90, 1827.

1890-'92. No operations, '91, 2022; '92, 1668.

**Physical Characteristics.**

Description of the bayou, '90, 1917.

**Projects.**

History of projects and plans for improvement, '90, 1914.

By Capt. Howell, 1872, for removal of obstructions and clearance of a channel through Cypress Bayou; estimated cost, \$50,000, '73, 622. Completed in 1880, '80, 1280; '86, 229.

By Capt. Bergland, 1885, for straightening and marking present channel, cutting stumps, and reopening cuts by dredging; estimated cost, \$18,000, '85, 1494; '87, 194.

**DAN RIVER, VA. AND N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 168.)

**Appropriations.**

1880-'87 ..... \$50,500

List of appropriations, '88, 839.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 115; '89, 133; '90, 120.

**ENGINEER IN CHARGE.**

S. T. Abert, U. S. agent, 1878'— Reports, '88, 838; '89, 1023; '90, 1083.

**Operations.**

1887-'88. 1,900 cubic yards loose and blasted rock removed; 981 cubic yards sand and gravel dredged from the channel; 497 linear feet spur dams completed, '88, 839.

1888-'89. 174 linear feet crib work built, 208 linear feet brush mats sunk, and 140 cubic yards rock used in dam construction, '89, 1023.

1889-'90. No operations for lack of funds, '90, 1084.

**Projects.**

By S. T. Abert, 1879, for securing a channel 35 feet wide with a depth of 3 feet at low water for a distance of 77 miles by dredging, rock excavation, and the construction of locks and dams; estimated cost, \$658,579.20, '79, 666, 671; '80, 788. Revised in 1880 for a channel 35 feet wide, with a depth of 1½ feet in pools and 2 feet in rapids without locks and dams; estimated cost, \$52,000, '80, 788. Increased \$5,500 in 1886-'87, '86, 147; '87, 954.

**D'ARBONNE RIVER, LA.—(See BAYOU D'ARBONNE, LA.)****DARIEN HARBOR, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 169.)

**Appropriations.**

1878-'79 ..... \$8,000

1890 ..... 25,000, '91, 1529.

1892 ..... 25,000, '92, 1259.

Total ..... 58,000



**DARIEN HARBOR, GA.—Continued.****Contracts.**

1891. P. S. Ross, for dredging, at 23 cents per cubic yard, '91, 1530.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 180; '92, 177.

ENGINEER IN CHARGE.

Capt. O. M. Carter, 1890-'—. Reports, '91, 1528; '92, 1257.

**Operations.**

1890-'91. 13,194 cubic yards material dredged, '91, 1528.

1891-'92. 73,445 cubic yards material dredged, '92, 1258.

**Projects.**

By Col. Gillmore, 1885, for improvement of the river between Darien and Doboy, a distance of about 10 miles, by the formation of a channel through the shoals below Darien 12 feet deep at low water, the channel to be obtained by dredging and maintained by the construction of wing dams at five of the shoals; estimated cost, \$170,000, '85, 1238, 1242; '91, 1528.

**DAVIS ISLAND DAM.—(See OHIO RIVER.)****DEALS ISLAND, MD. Upper thoroughfare between island and mainland.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 170.)

**Appropriations.**

1881..... \$5,000, '81, 884.

**Engineers.**

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1884-'—. Report, '88, 751.

**Operations.**

1887-'88. Operations postponed to await adequate appropriations, '88, 751.

**Projects.**

By Lieut. Col. Craighill, 1882, to provide a harbor of refuge for small vessels and a landing place for steamers by dredging an anchorage basin, with an approach from deep water, and the construction of a breakwater to protect the dredged channel from filling; estimated cost, \$20,000, '82, 856; '83, 680.

**DEEP RIVER, WASH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 420.

ENGINEER IN CHARGE.

Maj. T. H. Handbury, 1890. Report, '91, 3378.

**Physical Characteristics.**

Description of the locality, '91, 3378.

**Plans.**

In 1890 Maj. Handbury did not consider the locality worthy of improvement, '91, 3378.

**Surveys.**

Examination ordered by act of September 19, 1890. Made under direction of Maj. Handbury, '91, 3378.

**DELAWARE BAY, DEL.—EXAMINATION FOR A NATIONAL HARBOR OF REFUGE.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 119; '92, 119.

**DELAWARE BAY, DEL.—Continued.****Engineers—Continued.****BOARD OF ENGINEERS.**

Convened at Philadelphia, Pa., December 11, 1890, by S. O. No. 68, to examine and report upon a proposed national harbor of refuge for deep-draft vessels near the mouth of Delaware Bay. Reports, '91, 1120; '92, 941. (Col. Craighill, Maj. Raymond, and Capt. Bixby.)

**Plans.**

In 1890 the Board recommended postponement of a definite decision upon the question of location until after survey of the locality, '91, 1121. After survey, in 1892, the Board proposed the formation of a harbor of refuge, with a minimum low-water depth of 24 feet, by construction of a stone breakwater  $1\frac{1}{2}$  miles in length, extending in a general northwest and southeast direction on the east branch of the shears, off Cape Henlopen, Del.; also the construction of a row of ten ice piers across the upper end of the harbor to protect the anchorage against ice descending the bay; total estimated cost, \$4,665,000, '92, 942, 943.

**DELAWARE BAY, Ice harbor at head of.—SURVEY OF.**

(Continued from Vol. II, p. 173.)

**Appropriations.**

1882..... \$25,000, '82, 787.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 80; '89, 98; '90, 89; '91, 113; '92, 115.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1885-'90. Reports, '88, 704; '89, 868.

Maj. C. W. Raymond, 1890-'—. Reports, '90, 887; '91, 1072; '92, 930.

**Plans.**

Maj. Raymond reports, 1890, that the construction of an ice harbor at the head of Delaware Bay should be deferred to await the completion of the improved ship channel between Philadelphia and the sea. Estimated cost of ice harbor from \$400,000 to \$600,000, '90, 887; '91, 1073; '92, 931.

**DELAWARE BREAKWATER, DEL.**

(Continued from Vol. II, p. 173.)

**Appropriations.**

1822-'87 .....	\$2,448,353.70
1888.....	100,000.00, '88, 708.
1890.....	80,000.00, '90, 891.
1892.....	50,000.00, '92, 935.

Total ..... 2,678,353.70

List of appropriations, '92, 934.

**Commerce.**

Importance of the work, '88, 707.

**Contracts.**

1888. Brandywine Granite Company, for furnishing and placing random stone, at \$2.23 per ton, '89, 873.

1891. Brandywine Granite Company, for furnishing and placing random stone, at \$2.17 per ton, '91, 1077.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 81; '89, 100; '90, 90; '91, 115; '92, 116.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1888-'90. Reports, '88, 707; '89, 871; '90, 891.

Maj. C. W. Raymond, 1890-'—. Reports, '90, 889; '91, 1075, 1078; '92, 933.

**ASSISTANT.**

L. Y. Schermerhorn. Report, '90, 894.

**DELAWARE BREAKWATER, DEL.—Continued.****Operations.**

- 1887-'88. No operations for lack of funds, '88, 707.  
 1888-'89. 23,195 tons random stone placed in Delaware Breakwater gap, '89, 871.  
 1889-'90. 17,755 tons random stone placed in the breakwater gap, '90, 889.  
 1890-'91. Quarrying of stone begun under contract, '91, 1076.  
 1891-'92. 34,022 tons of granite placed in breakwater gap, '92, 933.

**Projects.**

The original project was submitted in 1828 by a Board of Commissioners appointed by Congress, and proposed the construction, in the concavity of the bay just inside of Cape Henlopen, of two massive works on the pierres perdues or rip-rap system, separated by an interval of 1,390 feet; the larger work, called the breakwater, to afford a safe anchorage during gales from the north and east, and the lesser, called the ice breaker, to protect shipping against northeast gales and the heavy drifting ice in the bay, '79, 453; '86, 119.

This project was completed in 1869, under aggregate appropriations of \$2,192,103.70, and resulted in the construction of a breakwater 2,558 feet long, and an ice breaker 1,359 feet long on top, '79, 453; '86, 119, 840.

The Board of Engineers of 1871 and 1879 recommended the closure of the interval between the breakwater and ice breaker by a work similar to those already built, at an estimated cost of \$600,000 to \$1,314,200, '72, 756; '79, 456.

By Capt. Ludlow, 1882, for closing the gap between the breakwater and ice breaker, by a random-stone foundation carrying a concrete superstructure; the foundation to be brought to a height of 12 feet below mean low water, with a top width of 48 feet; the concrete superstructure to have a bottom width of 24 feet, a top width of 12 feet, and to rise 12 feet above mean low water. The estimated cost was \$675,000, '82, 792; '86, 119.

In 1883 a brush-mattress foundation under the random-stone superstructure was adopted, '83, 130, 659; '84, 845.

In 1884 the pile bridge forming a part of the project of 1882 was abolished, '84, 846; '85, 122, 847; '87, 81.

Causes for probable increase in cost as originally estimated, '87, 806.

By Lieut. Col. Robert, 1890, for completion of the Delaware Breakwater by a substructure of rubble stone and a superstructure of concrete; the rubble mound to have side slopes of 1 vertical to 2 horizontal on the sea face, and 1 vertical to 1½ horizontal on the harbor face; its top to be 62 feet wide and 15 feet below mean low water; the superstructure is to have a cross section of 27 feet height and 27 feet width, its base being 15 feet below mean low water, and its top 7½ feet above mean low water; the material of which it is composed to be concrete blocks up to about 2 feet above high water, the topping, after the blocks have settled, to be a mass of concrete; the foot of the superstructure to be protected on the sea face by 4-ton blocks of stone; estimated cost, \$500,000, '90, 893.

In 1891 the revised project of Maj. Raymond provided for a rubble mound, to be raised to the level of mean low water, with a width of 40 feet at that level, and a superstructure above low water, 14 feet high and 20 feet wide on top, to be formed by heavy stone laid in position, the interior spaces to be filled with rubble; estimated cost, \$400,000, '91, 1083.

**DELAWARE RIVER.—IMPROVEMENT OF, INCLUDING BETWEEN BRIDEBURG AND TRENTON, BELOW BRIDEBURG, AT SMITHS ISLAND, AT SCHOONER LEDGE, AND AT REEDY ISLAND.**

(See also DELAWARE RIVER AT PHILADELPHIA.)

(Continued from Vol. II, p. 174.)

**Appropriations.**

1802-'87 .....	\$1,762,000
1888 .....	250,000, '88, 675.
1890 .....	250,000, '90, 875.
1892 .....	50,000, '92, 904.

Total .....

2,312,000

List of appropriations, '92, 903.

**Commerce.**

Commercial requirements between Philadelphia and Trenton, '90, 880.

**DELAWARE RIVER—Continued.****Contracts.**

1888. J. H. Ward, for furnishing and placing stone in Mifflin Bar Dike, at \$1.19 per cubic yard, '88, 676. J. A. Bowker, for furnishing and placing stone in Fishers Point Dike, at \$1.49 per cubic yard, '89, 860. American Dredging Company, for dredging at Mifflin Bar, at 18 cents per cubic yard, '89, 859. Atlas Dredging Company, for dredging at Bulkhead Shoal, at 24 cents per cubic yard, '89, 859. Davis & Irwin, for 500 linear feet pile and stone dike at Fishers Point, at an aggregate of \$8,521.63, '89, 860. Davis & Irwin, for 500 linear feet of pile dike at Fishers Point, at an aggregate of \$5,379.75, '89, 861. Brandywine Granite Company, for brush and stone dike construction at Reedy Island; brush mattress, at \$1.55 per cubic yard, and stone, at \$1.45 per cubic yard, '88, 676. E. H. Gaynor, for brush and stone dike construction at Reedy Island; brush mattress, at \$1.25 per cubic yard, and stone, at \$1.30 per cubic yard, '89, 860.
1890. W. T. Gaynor, for 600 linear feet of pile and stone dike construction at Kinkora Bar, at an aggregate of \$9,003, '90, 876. F. C. Somers, for dredging at Kinkora Bar, at 7.9 cents per cubic yard, '91, 1026. C. McLenn, for dike construction at Bulkhead Bar, '92, 902.
1891. I. H. Hathaway, for pile and stone dike construction at Bulkhead Bar, at \$49,919, '91, 1027.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 76; '89, 94; '90, 84; '91, 108; '92, 110.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1885-'90. Reports, '88, 669; '89, 847; '90, 878.

Maj. C. W. Raymond, 1890-'— . Reports, '90, 866; '91, 1022; '92, 900.

**Operations.**

- 1887-'88. 23,107 cubic yards stone placed in Mifflin Bar Dike, '88, 672. 20,000 cubic yards material dredged from the channel across Smiths Island Bar; 2,200 cubic yards brush mattress and 18,300 cubic yards stone placed in Reedy Island Dike, extending the same 2,000 feet, '88, 673, 674.
- 1888-'89. 6,141 cubic yards stone placed in Fishers Point Dike, '89, 851. 1,000 linear feet of pile dike built at Fishers Point, '89, 852. 52,471 cubic yards material dredged from main ship channel near Port Richmond, '89, 852. 6,380 cubic yards stone placed in Mifflin Bar dike, '89, 854. 62,221 cubic yards material dredged from channel at Bulkhead Shoal; 3,673 cubic yards of brush and 20,267 cubic yards stone placed in Reedy Island dike; 250 cubic yards rock removed at Schooner Ledge, '89, 856, 857.
- 1889-'90. 600 linear feet of pile and stone dike built at Kinkora Bar, '90, 869. 10,773 cubic yards stone placed in 3,500 linear feet of dike at Five Mile Bar, '90, 870. 89,790 cubic yards material dredged from main ship channel at Port Richmond, '90, 871. 1,178 cubic yards rock removed from the channel near the foot of Otis street, Philadelphia; 20,452 cubic yards brush mattress and 10,397 cubic yards stone placed in Reedy Island Dike, '90, 872, 874.
- 1890-'91. 600 linear feet of pile and stone dike and 200 linear feet of earthen embankment completed at Kinkora Bar, '91, 1023. 1,300 linear feet of east dike completed at Bulkhead Bar, '91, 1024.
- 1891-'92. Dike completed, and channel 175 feet wide and 12 feet deep dredged across Kinkora Bar; 1,300 linear feet of east dike and 1,350 linear feet of west dike built, and 51,810 cubic yards material dredged at Bulkhead Bar, '92, 903.

**Physical Characteristics.**

Current observations at eight cross sections between Fishers Point and Bombay Hook, '89, 848.

Tidal observations between Bridesburg and Trenton, '90, 878, 879.

Condition of the river channel between Philadelphia and Trenton, '90, 880.

**Plans.**

Lieut. Col. Robert, 1890, considers that any valuable and permanent improvement of the section of the river between Bordentown and Trenton would require the expenditure of a much larger sum than would be justified by existing commercial requirements, '90, 882.

**Projects.**

The projects prior to 1885 for the improvement of the river between Philadelphia and the bay have been directed toward the formation of channels 24 feet deep at mean low water across the bars below Philadelphia by means of dredging, except at Schooner Ledge, where solid rock was to be removed, '85, 115, 804; '86, 113.

The Board of Engineers of 1885 recommended the formation of a ship channel from a point opposite the upper end of Petty's Island to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean low water. The formation of such a channel to be obtained, except at Schooner

**DELAWARE RIVER—Continued.****Projects—Continued.**

Ledge, where rock would require to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging where necessary as an aid to such contracting and regulating works; estimated cost, \$2,425,000, '85, 802, 822, 830. The project for the improvement of the river between Trenton and Philadelphia to be submitted after completion of detailed surveys, '85, 799, 822; '86, 113.

By Lieut. Col. Robert, 1888, for the removal of 1,200 cubic yards of ledge rock in the channel near the foot of Otis street, Philadelphia; estimated cost, \$3,800, '90, 871.

By Lieut. Col. Robert, 1890, for the improvement of the river between Philadelphia and Trenton by the formation of a 12-foot low-water channel across Kinkora Bar by means of a pile and stone dike partly closing the slough south of Newbolds Island, supplemented by dredging on the line of the proposed channel; estimated cost, \$15,000, '90, 869.

By Maj. Raymond, 1890, for improvement of Bulkhead Shoal by a modification of the project of 1885, whereby the improvement of the locality is to be accomplished by the construction of two pile and stone high-water dikes; the east dike, 4,200 feet in length, starting from the New Jersey shore and passing obliquely across the eastern ebb channel, and the west dike, 6,800 feet in length, situated upon the opposite side of the bar; estimated cost of both dikes, \$280,000, '90, 873, 874.

**Surveys.**

Examinations of Five Mile Bar, in 1887 and 1888, to determine extent of dike's action in improving the bar, '88, 670.

Survey of Reedy Island. Made, 1887, under direction of Lieut. Col. Robert, '88, 674.

Examination of Kinkora Bar. Made, 1889, under direction of Lieut. Col. Robert, '89, 849.

Examination of Smith Island Bar. Made, 1889, under direction of Lieut. Col. Robert, '89, 853.

Survey of Mifflin Bar. Made, 1888, under direction of Lieut. Col. Robert, '89, 855.

Examinations of Smith Island Bar and Shoal, Greenwich Shoal, Mifflin Bar, and survey of Schooner Ledge. Made, 1890, under direction of Maj. Raymond, '90, 867, 868.

**MAPS.**

'88, 670, 672, 682; '90, 869, 870, 872; '92, Atlas, 8.

**DELAWARE RIVER AT PHILADELPHIA, PA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 178.)

**Appropriations.**

1888.....	} Survey ..	\$5, 000, '88, 678.
1890.....		"500, 000, '89, 863.
1891.....		200, 000, '90, 884.
1892.....		300, 000, '92, 911.
		41, 000, '92, 911.

Total ..... 1, 046, 000

**Commerce.**

Existing commerce and necessity for increased channel facilities, '88, 684, 687.

**Contracts.**

Jas. A. Mundy & Co., for dredging, at 10½ cents per cubic yard, and depositing and spreading material on League Island, at 9½ cents per cubic yard, '92, 907. Time for completion of contract extended, '92, 911.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 78, 86; '89, 96; '90, 86; '91, 425; '92, 112.

**BOARD OF ENGINEERS.**

Convened at Philadelphia, 1888, to report upon a plan for the removal of Smith, Windmill, and Pettys islands in the Delaware River, between Philadelphia and Camden. Report, '88, 679. (Col. Craighill and Lieut. Cols. Comstock and Robert.)

\* Not to exceed \$300,000 of the amount to be applied to purchase of islands, provided that no part thereof be expended until title to the lands be acquired and vested in the United States without charge to the latter beyond said \$300,000.

**DELAWARE RIVER AT PHILADELPHIA, PA.—Continued.****Engineers—Continued.****BOARD OF ENGINEERS—Continued.**

United States Commission Advisory to the Board of Harbor Commissioners of the Port of Philadelphia. Report, '88, 718, 720. (Capt. White, U. S. N.; H. Mitchell, U. S. C. and G. S., and Lieut. Col. Robert.)

Convened at Philadelphia, October 10, 1890, by S. O. No. 20, to report upon the establishment of harbor lines in the port of Philadelphia. Report, '91, 1122. (Cols. Craighill and Comstock and Maj. Raymond.)

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1888-'90. Reports, '88, 678, 722; '89, 863.

Maj. C. W. Raymond, 1890-'— . Reports, '90, 882; '91, 1121; '92, 906, 913, 914.

**Legislation.**

Legal proceedings for the condemnation of Smith and Windmill islands, '89, 863; '90, 883.

**Operations.**

1890-'91. 10,318 cubic yards material dredged, '92, 908.

1891-'92. 312,111 cubic yards material dredged, and 2,330 linear feet of revetment removed, '92, 908, 910.

**Physical Characteristics.**

Description of Smith, Windmill, and Pettys islands, '88, 680.

**Projects.**

By Board of Engineers, 1888, for improvement of the Delaware River between Philadelphia, Pa., and Camden, N. J., by the removal of Smith, Windmill, and a portion of Pettys islands and adjacent shoals, securing a channel from Kaighns Point to Fishers Point 2,000 feet wide. The depth of channel on the Pennsylvania side, commencing about 300 feet from the present wharf line, so as to admit of wharf extension, to be 26 feet, mean low water, for 1,000 feet; the depth across the remaining half of the channel to decrease from 26 to 12 feet on the New Jersey side; estimated cost, \$3,500,000, '88, 682, 684. (Col. Craighill and Lieut. Cols. Comstock and Robert.)

**Surveys.****MAPS.**

'88, 682.

**DES MOINES RAPIDS, MISSISSIPPI RIVER.—IMPROVEMENT OF, AND OPERATION OF CANAL AND CONSTRUCTION OF DRY DOCK AT.**

(Continued from Vol. II, p. 178.)

**Appropriations.**

1856-'79 .....	\$4, 982, 200	
1880-'87, operation of canal .....	30, 000	
improvement of rapids .....	151, 250	
construction of dry dock .....	108, 750	
1888, improvement of rapids .....	35, 000	} '88, 1520, 1528.
construction of dry dock .....	16, 250	
1890, improvement of rapids .....	22, 000	'90, 2061.

Total .....

5, 345, 450

List of appropriations, '88, 1520; '91, 2172, 2175.

**Commerce.**

1888. Statement of commerce passing canal, '88, 1521.

1889. Statement of commerce passing canal, '89, 1772.

1890. Statement of commerce passing canal, '90, 2064.

1891. Statement of commerce passing canal, '91, 2180.

Total amount of traffic passing through canal from 1877 to 1891, '91, 2182.

**Contracts.**

1888. Patterson Bros., for stone, at \$8,259, '89, 1771. W. J. Rwatch, for iron, at \$581.94, '89, 1770. Carson & Rand, for timber, at \$6,915, '89, 1770.

1889. Patterson Bros., for stone, at \$10,350, '89, 1771. Meacham & Wright, for hydraulic cement, at \$1.16 per barrel, '89, 1771. F. W. Menke Stone and Lime Company, for construction of stone office building, at \$5,952, '90, 2061.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 198, 199; '89, 233; '90, 208, 209; '91, 266; '92, 254, 255.

**ENGINEER IN CHARGE.**

Maj. A. Mackenzie, 1881-'—. Reports, '88, 1518, 1521, 1527; '89, 1767, 1772, 1776; '90, 2060, 2064, 2070; '91, 2172, 2174; '92, 1772, 1773.

**DES MOINES RAPIDS, MISSISSIPPI RIVER—Continued.****Engineers—Continued.****ASSISTANT.**

M. Meigs. Reports, '88, 1525, 1528; '89, 1774; '90, 2061, 2067, 2070; '91, 2173, 2183; '92, 1772, 1777.

**Operations.**

1887-'88. 2,143 square yards of slope wall laid on canal embankment, '88, 1519. Operations and care of canal, '88, 1521, 1523, 1525. 47,333 cubic yards material dredged from the canal, '88, 1525. 2,232 cubic yards masonry and 147 cubic yards riprap laid, and 1,713 cubic yards earth and 272 cubic yards rock excavated at dry dock, '88, 1528.

1888-'89. Construction of floating boom, rock removal above Nashville, and elevation of lock walls at lower lock, '89, 1768. Operation and care of canal, '89, 1772. 86,278 cubic yards material dredged from the canal, '89, 1775. Grading and paving of bottom of dry dock completed, pump house built, and pumps set up, '89, 1776.

1889-'90. Lock chamber walls completed; stone office building built at lower lock, and sluice tender's cottage at Sandusky; Sandusky sluice completed, '90, 2062. Operation and care of canal, '90, 2064. 23,830 cubic yards material dredged from the canal, '90, 2069. Dry dock completed, '90, 2070.

1890-'91. 3,318 cubic yards riprap face stone laid in canal embankment; work of raising lock walls of middle lock completed, '91, 2172. Operation and care of canal and dry dock, '91, 2174. History of dry dock construction at the Des Moines Rapids Canal, '91, 2176. Lock completed in accordance with approved project, '91, 2172.

1891-'92. 1,017 cubic yards riprap and 996 cubic yards rubble stone used in repair of canal embankment; 1,271 square yards of slope wall laid; lock walls raised and lock grounds filled and graded at middle lock; operation and care of canal and dry dock, '92, 1772, 1773.

**Projects.**

The project of 1866 proposed the construction of a closed canal about 8 miles in length, reaching from Keokuk to Nashville, and an open canal through the rocky bed of the river for a distance of about 4 miles, from Nashville to Montrose; the depth of water to be obtained was from 5 to 6 feet, '67, 36, 264, 281, 335. See also Index, Vol. I, p. 197.

The closed canal was so far completed in 1877 as to permit passage of boats, and was opened to navigation on August 22, 1877, '78, 101, 739, 742.

In 1880 it was proposed to raise the side walls of the middle lock, and build two guiding cribs at the guard lock, '80, 1562; '84, 1577.

In 1882 Maj. Mackenzie proposed the construction of a dry dock, in connection with the canal, 400 feet long, 100 feet wide, and located on the river side of the canal above the middle lock; estimated cost, \$125,000, '83, 1422, 1423.

In 1884 it was proposed to place two sluices opposite the largest creek to prevent silt being carried into the canal, '84, 1577; '86, 1467.

From 1856 to 1886 \$4,517,950 had been appropriated for the construction of the canal and channel through the rapids, \$360,500 for the maintenance and operation of the canal, and \$108,750 for the construction of a dry dock, leaving amount required to complete canal project \$101,745, and the dry dock, \$16,250, '86, 1467, 1469, 1478.

In 1889 Maj. Mackenzie proposed raising the lock walls of the lower lock, the construction of an office building at the lower lock, rock excavation above guard lock, sluice construction, and protection of outside slope of canal embankment; estimated cost, \$17,194, '89, 1768.

Project completed in 1892, '92, 1772.

**Surveys.****MAPS.**

'91, 2177.

**DETROIT RIVER, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 180.)

**Appropriations.**

1874-'87 .....	\$572, 500. 00
1888 .....	130, 500. 00, '88, 1980.
1890 .....	26, 881. 38, '91, 2794.
1892 .....	30, 000. 00, '92, 2482.

Total ..... 759, 881. 38

List of appropriations, '92, 2482.

**DETROIT RIVER, MICH.—Continued.****Commerce.**

Benefits of the improvement to commerce, '88, 1797.

**Contracts.**

1888. Dunbar & Sullivan, for rock removal, '89, 2272.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 267; '89, 317; '90, 287; '91, 361; '92, 343.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1883— Reports, '88, 1978; '89, 2272; '90, 2745; '91, 2793; '92, 2481.

**Operations.**

1887-'88. 81,078 cubic yards solid rock and 1,052 cubic yards loose rock removed, '88, 1979.

1888-'89. 8,508 cubic yards solid rock removed, '89, 2272.

1889-'90. 16,583 cubic yards solid and 1,766 cubic yards loose rock removed, '90, 2745.

1890-'91. 1,213 cubic yards of solid and 1,554 cubic yards loose rock removed from the channel, '91, 2793.

1891-'92. No operations, '92, 2481.

**Physical Characteristics.**

Water-level curves at Lime Kiln Crossing, Detroit River, '88, 1979.

**Projects.**

By Maj. Weitzel, 1874, for improvement of Lime Kiln Crossing by excavation through the rock of a curved channel 300 feet wide and 20 feet deep; estimated cost, \$1,166,500, '80, 222.

Modified, in 1883, by Maj. Farquhar to a straight channel of the same dimensions, at an additional cost of \$40,000, '83, 1885; '87, 2268. Reduction in ultimate cost of the work, '86, 326; '87, 2268.

In 1886 Col. Poe proposed increasing the width of the straight channel to 400 feet, at an estimated cost of \$168,000, '86, 1843; '87, 2268; '92, 2481.

**Surveys.**

Examination of the American Channel ordered by act of September 19, 1890. Made, 1890, under direction of Col. Poe, '91, 2809.

**MAPS.**

'90, 2746; '91, 2794.

**DETROIT RIVER, MICH., Channel at Grosse Pointe.—IMPROVEMENT OF.****Appropriations.**

1888..... \$5,000, '89, 2270.

**Commerce.**

Gross annual tonnage passing through Grosse Pointe Channel, '89, 2268.

**Contracts.**

1889. Dunbar & Sullivan, for hire of one tug and two dump scows, at \$10 per hour, '90, 2741.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 267; '89, 315; '90, 285, 289; '91, 359; '92, 342.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1883— Reports, '88, 1978; '89, 2267; '90, 2740; '91, 2790; '92, 2478.

**Operations.**

1887-'89. No operations, '88, 1978; '89, 2270.

1889-'90. 2,500 cubic yards material dredged, '90, 2741.

1890-'92. No operations, '91, 2790; '92, 2479.

**Plans.**

By Col. Poe, 1890, for excavation of a channel through the flats off Grosse Pointe, 800 feet wide and 20 feet deep, involving the removal of 3,140,000 cubic yards, at a cost of \$690,800; or for a channel 800 feet wide and 19½ feet deep, involving the removal of 2,515,000 cubic yards, at a cost of \$553,300, '90, 2742.

**Projects.**

By Col. Poe, 1888, for improvement of Grosse Pointe Channel, at the head of the Detroit River, by dredging to a depth of 19½ feet and a width of 800 feet, involving the removal of about 2,515,000 cubic yards, at an estimated cost of \$553,300, '88, 1978.

In 1891 Col. Poe proposed the excavation of a channel 800 feet wide, 5½ miles long, and 20 feet in depth, at a cost of \$956,825, '91, 2790; '92, 2479.



**DETROIT RIVER, MICH., Channel at Grosse Pointe—Continued.****Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Col. Poe, '90, 2750.

**DOBOY AND SAPELO, GA.—EXAMINATION OF.****Commerce.**

Commercial interests of the port of Darien, '92, 1298.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '92, 181.

ENGINEER IN CHARGE.

Capt. O. M. Carter, 1890. Report, '92, 1294, 1295.

ASSISTANT.

G. W. Brown. Report, '92, 1299.

**Physical Characteristics.**

Description of the locality, '92, 1296.

**Plans.**

After an examination and survey, in 1891, Capt. Carter did not consider the benefit to be derived from the proposed improvement commensurate with the cost thereof, '92, 1299.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Carter, '92, 1295.

**DOBOY BAR, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 181.)

**Appropriations.**

1886-'87 ..... \$10,000 \*

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 141.

ENGINEER IN CHARGE.

Lieut. O. M. Carter, 1888-'—. Report, '88, 1041.

**Operations.**

1887-'88. Removal of Doboy Bar continued by harrowing and hydraulic excavation, '88, 1042.

**Plans.**

Lieut. Carter, 1888, did not consider the present or prospective demands of commerce sufficient to warrant further expenditure, '88, 1044.

**Projects.**

By Col. Gillmore, 1887, for formation of a channel over the bar by hydraulic excavation and propeller sluicing, '87, 1181; '88, 1041.

**Surveys.**

MAPS.

'88, 1042.

**DOBOY AND SAPELO, GA., Inside route between.—EXAMINATION FOR.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 185.

**SAVANNAH, GA., AND FERNANDINA, FLA., Inside route between.—EXAMINATION FOR.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 185.

\* From Altamaha River appropriation, '87, 1179.

**DRUM INLET, N. C.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 170, 1425.

ENGINEER IN CHARGE.

Capt. W. H. Bixby, 1890. Report, '91, 1425.

ASSISTANT.

Lieut. M. M. Patrick. Report, '91, 1427.

**Physical Characteristics.**

Description of the locality, '91, 1426.

**Plans.**

In 1890 Capt. Bixby did not consider the locality worthy of improvement, '91, 1426.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Bixby, '91, 1426.

**DUBUQUE HARBOR, IOWA.—(See MISSISSIPPI RIVER FROM SAINT PAUL TO DES MOINES RAPIDS.)****DUBUQUE, IOWA.—ICE HARBOR AT.**

(Continued from Vol. II, p. 182.)

**Appropriations.**

1844-'84 ..... \$69, 500

**Engineers.**

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1880-'—. Report, '88, 1529.

**Operations.**

1887-'88. No operations, '88, 1529.

**Projects.**

By Maj. Mackenzie, 1880, for the formation of an ice harbor by dredging a basin at Waples Cut, with an area of about 11 acres and a low-water depth of 6 feet; estimated cost, \$40,000, '82, 1770, 1771. Area increased in 1884 to about 16 acres, '84, 1572; '87, 222.

**DUCK ISLAND HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 183.)

**Appropriations.**

1890 ..... \$25, 000, '91, 758.

1892 ..... 35, 000, '92, 666.

Total ..... 60, 000

**Contracts.**

1891. E. S. Belden, for riprap breakwater construction, at 94 cents per ton, '92, 758.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 66; '92, 70.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1891-'—. Reports, '91, 757; '92, 664.

**Operations.**

1890-'91. 5,126 tons of riprap placed in the breakwater, completing 270 linear feet of work, '91, 758.

1891-'92. 18,336 tons of riprap placed in the breakwater, completing 676 feet, '92, 665.

**Physical Characteristics.**

Description of the breakwater, '91, 757.

**Projects.**

By Maj. Barlow, 1882, for the formation of a small harbor of refuge by the construction of a breakwater from 1,200 to 1,800 yards in length, at an estimated cost of \$200,000, '87, 648.

**DUCK ISLAND HARBOR, CONN.—Continued.****Projects—Continued.**

Modified and enlarged by Lieut. Col. Houston, 1886, providing for the construction of three breakwaters of riprap, one extending westerly from Duck Island, 3,000 feet long; one extending northeast from Duck Island, 1,750 feet long, and the third extending southwesterly from Menunketesuck Point, 1,130 feet long. These breakwaters to be of 10 feet width at the top, to extend to 6 feet above high water, and to enclose an area of about 115 acres; estimated cost, \$463,540, '87, 642; '91, 757.

**DUCK RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 184.)

**Appropriations.**

1880-'82 ..... \$13,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 210.

ENGINEER IN CHARGE.

Lieut. Col. J. W. Barlow, 1886-'—. Report, '88, 1610.

**Operations.**

1887-'88. No operations since 1883, when it was stated that the improvement accomplished sufficed for the present and prospective needs of commerce, '88, 1610.

**Plans.**

By Maj. King, 1879, for the improvement of the river from its mouth to Centerville, a distance of 68 miles, by rock and gravel excavation, construction of wing dams, and removal of snags and overhanging trees, so as to give a 3-foot navigation during six months of the year; estimated cost, \$35,118, '80, 1684.

**DULUTH HARBOR, MINN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 184.)

**Appropriations.**

1871-'87 ..... \$436,250  
 1888 ..... 80,000, '88, 1807.  
 1890 ..... 100,000, '90, 2288.  
 1892 ..... 125,000, '92, 2130.

Total ..... 741,250

List of appropriations, '88, 1806; '91, 2491.

**Commerce.**

Present needs of shipping, '89, 2006.

**Contracts.**

1888. Williams, Upham & Co., for dredging, at 15½ cents per cubic yard, '89, 2004.  
 1890. Williams, Dougherty & Upham, for dredging, at 14 cents per cubic yard, '91, 2492.

1892. F. H. Quinby and F. Omers, for construction of protection crib and repairs to canal pier, at a total of \$10,000, '92, 2130.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 229; '89, 268, 274; '90, 242, 247; '91, 311; '92, 297.

ENGINEERS IN CHARGE.

Maj. J. B. Quinn, 1886-'92. Reports, '88, 1803; '89, 2000; '90, 2285, 2310, 2311; '91, 2489.

Capt. W. L. Fisk, 1892-'—. Report, '92, 2126.

ASSISTANTS.

S. L. Rice. Report, '90, 2318.

Lieut. G. D. Fitch. Report, '90, 2320.

**Operations.**

1887-'88. 159,940 cubic yards of material dredged from harbor basin; general repairs to north and south canal piers, '88, 1805.

1888-'89. 172,860 cubic yards material dredged from Rice Point and North Shore channels, '89, 2003.

1889-'90. No operations, '90, 2285, 2286.

1890-'91. 234,866 cubic yards material dredged from Rice Point Channel, '91, 2489.

1891-'92. Dredging in North Shore Channel, '92, 2127.

**DULUTH HARBOR, MINN.—Continued.****Physical Characteristics.**

Description of the harbor, '89, 2000.

**Plans.**

By Maj. Quinn, 1890, for construction of a timber and stone breakwater, two parallel crib-work piers, and dredging canal to 22 feet; estimated cost, \$2,345,842, '90, 2318.

**Projects.**

By Board of Engineers, 1881, for maintenance of dredged areas, enlargement of harbor, by dredging, to accommodate vessels drawing 16 feet, and maintenance of piers bordering canal; estimated cost, \$212,988, '81, 2026; '86, 1627.

Revised in 1884 by Maj. Allen, making total cost of above project \$305,424, '84, 1811; '86, 1628; '87, 1940.

By Capt. Quinn, 1887, for dredging Rice Point Channel to 16 feet; estimated cost, \$119,552, '88, 1806. Total cost of projected improvement, \$332,540, '88, 1807.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Maj. Quinn, '90, 2311.

**MAPS.**

'91, 2490.

**DUMA AND CAPISTRANO, CAL.—EXAMINATION FOR DEEP-WATER HARBOR BETWEEN.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 394.

**DUNKIRK HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 185.)

**Appropriations.**

1827-'87 .....	\$476, 579. 38
1888 .....	15, 000. 00, '88, 2027.
1890 .....	20, 000. 00, '90, 2807.
1892 .....	20, 000. 00, '92, 2529.

Total ..... 531, 579. 38

**Contracts.**

1889. Hingston & Woods, for dredging, at 27 cents per cubic yard for mud and \$1 for loose rock, '89, 2358.

1891. G. C. Grimard, for construction and repair of breakwater and piers, at a total of \$14,970, '91, 2880.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 278; '89, 330; '90, 298; '91, 374; '92, 353.

ENGINEERS IN CHARGE.

Capt. F. A. Mahan, 1886-'90. Reports, '88, 2024; '89, 2358.

Maj. A. Stickney, 1890-'92. Reports, '90, 2804; '91, 2878.

Maj. E. H. Ruffner, 1892-'—. Report, '92, 2527.

**Operations.**

1887-'88. Nine cribs sunk in repair of west pier; breakwater harbor wall rebuilt, and decking repaired, '88, 2026.

1888-'89. Repairs to west pier by hired labor, '89, 2358.

1889-'90. Extensive repairs to west pier by hired labor; 14,370 cubic yards of mud and 120 cubic yards loose stone removed under contract, '90, 2805.

1890-'91. No operations, '91, 2879.

1891-'92. Construction of west pier superstructure; 2,900 cubic yards material dredged, '92, 2528.

**Physical Characteristics.**

Description of the locality, '88, 2027.

**Projects.**

By Board of Engineers, 1870, for reconstruction of "dummy crib" as a day beacon; construction of 2,860 feet of breakwater and an east pier; also dredging and blasting in the channel to 13 feet; estimated cost, \$350,000, '71, 216; '80, 229; '81, 315; '87, 2348.

**DUNKIRK HARBOR, N. Y.—Continued.****Projects—Continued.**

By Capt. Adams, 1883, for 860 linear feet of breakwater extension; estimated cost, \$60,200, '83, 1928.

In 1890 Maj. Stickney estimated that to complete the improvement as projected, without repair to existing structures, would require, including the appropriation of 1890, \$147,916, '90, 2807; '91, 2878.

**DUXBURY HARBOR, MASS.—EXAMINATION OF.**

(Continued from Vol. II, p. 186.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 32.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie, 1888. Report, '88, 472, 473.

ASSISTANT.

S. Haagensen. Report, '88, 475.

**Plans.**

By Lieut. Col. Gillespie, 1887, for improvement of the western branch of the Duxbury Channel by dredging a cut 3,600 feet long, 60 feet wide, and 6 feet deep at mean low water; estimated cost, \$13,200, '88, 474.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Gillespie, '88, 473.

MAPS.

'88, 474.

**EAGLE HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 187.)

**Appropriations.**

1866-'79 ..... \$97,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 233; '89, 272; '90, 245; '91, 315; '92, 300.

ENGINEERS IN CHARGE.

Maj. C. E. L. B. Davis, 1885-'89. Report, '88, 1821.

Maj. J. B. Quinn, 1889-'90. Reports, '89, 2020; '90, 2299.

Capt. W. L. Fisk, 1890-'— Reports, '91, 2505; '92, 2141.

**Operations.**

1887-'90. Project completed and no further operations contemplated, '88, 1821; '89, 2020; '90, 2299; '91, 2505; '92, 2142.

**Projects.**

The project for the improvement of this harbor was adopted in 1866, modified in 1868, 1874, and 1878, and completed in 1879, at a cost of \$93,000. As finished it consisted in opening a channel 130 feet wide and 14 feet deep through the rocky reef obstructing the entrance to the harbor, and defining the entrance through the reef by a guiding crib on each side of the channel, '79, 1480; '87, 1970; '88, 1821. Maj. Davis considered the work accomplished as fully satisfying the demands of commerce, '88, 1821; '91, 2505.

**EAST CHESTER CREEK, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 187.)

**Appropriations.**

1873-'87 ..... \$64,000

1888 ..... 5,000, '88, 576.

Total ..... 69,000

List of appropriations, '88, 576; '91, 809.

**EAST CHESTER CREEK, N. Y.—Continued.****Contracts.**

1888. Hartford Dredging Company, for dredging, at 45 cents per cubic yard, '88, 576.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 55; '89, 67; '90, 60; '91, 75; '92, 79.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1886—Reports, '88, 577; '89, 721; '90, 656; '91, 806; '92, 708.

**Operations.**

1887-'88. 1,772 cubic yards material dredged near Town Dock, '88, 575.

1888-'89. 11,067 cubic yards material dredged, '89, 724.

1889-'92. No operations, '90, 659; '91, 808; '92, 710.

**Physical Characteristics.**

Description of the creek, '88, 574.

**Projects.**

By Col. Newton, 1872, for providing, by dredging and rock removal, a channel 9 feet deep at high water from Pelhams Bridge to a point 3,000 feet above Lockwoods, a distance of 3 miles, that part of channel above Lockwoods to serve as a channel and tidal basin. A modification of 1873 consisted of proposed timber dikes, 5,800 feet in length, to confine the channel; estimated cost, \$136,500, '72, 815; '73, 939; '77, 249; '86, 663.

In 1887 the estimate of cost was raised to \$221,100, '87, 628.

In 1891 \$55,000 was estimated as sufficient for completion of the improvement contemplated, '91, 809; '92, 708.

**EAST RIVER, N. Y.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 83; '90, 74; '91, 86, 425.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie, 1888. Reports, '90, 761; '91, 899.

ASSISTANT.

G. W. Kuehule. Report, '90, 765.

**Plans.**

By Lieut. Col. Gillespie, 1890, for rock removal and dredging so as to obtain an 18-foot channel between Broome and Twenty-third streets in the East River; estimated cost, \$267,996, '90, 764.

**Surveys.**

Survey from the foot of Broome street to the foot of Twenty-third street, New York City, ordered by act of August 11, 1888. Made, 1890, under direction of Lieut. Col. Gillespie, '90, 761.

**EAST RIVER, N. Y.—IMPROVEMENT OF, AT HELL GATE.**

(Continued from Vol. II, p. 188.)

**Appropriations.**

1852-'87 .....	\$3, 680, 700
1888 .....	250, 000, '88, 608.
1890 .....	200, 000, '90, 719.
1892 .....	150, 000, '92, 805.

Total ..... 4, 280, 700

List of appropriations, '88, 606; '91, 905; '92, 805.

**Contracts.**

1890. R. G. Packard, for removal of material other than bowlders, at 85 cents per cubic yard, and bowlders, at \$2.50 per ton, '91, 902.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 60; '89, 75; '90, 66; '91, 86; '92, 90.

**EAST RIVER, N. Y.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Lieut. Col. W. McFarland, 1885-'89. Report, '88, 603.

Lieut. Col. G. L. Gillespie, 1889-'— . Reports, '89, 772; '90, 713; '91, 899; '92, 797.

**Legislation.**

Act by New York legislature incorporating the East River Bridge Company, '92, 805.

**Operations.**

1887-'88. 19,548 tons rock removed, '88, 605.

1888-'89. 1,410 tons rock removed by hired labor, '89, 775.

1889-'90. 47,398 tons rock removed, '90, 716.

1890-'91. Removal of rock at Flood Rock and Diamond Reef; 3,435 cubic yards of material and 960 tons of bowlders removed from Shell Reef; 24,040 tons of rock removed from reef off Diamond Reef, '91, 902, 904.

1891-'92. 20,872 tons of rock blasted and removed at Flood Rock; 52,803 cubic yards material dredged and 2,800 tons rock removed at Shell Reef and Middle Ground; 1,763 tons of rock removed at Ferry Reef; 1,211 tons of rock removed from reef off Diamond Reef, '92, 800, 803.

**Physical Characteristics.**

Description of obstructions at Hell Gate, '88, 603.

**Projects.**

In 1851-'52, under an appropriation of \$20,000, an effort was made to improve navigation through Hell Gate by the removal of rock through the aid of surface blasting, '68, 732.

The project for the improvement of Hell Gate was proposed by Col. Newton in 1867. It was subsequently modified in 1868, 1874, 1880, and 1884 by extending it to embrace the removal of other reefs in the East River. It now includes the removal, to a depth of 26 feet at mean low water, of all the dangerous reefs in Hell Gate, Diamond Reef, and North Brothers Island Reef in the East River; the removal of Coenties Reef to 25½ feet, and a number of smaller rocks in the shoaler parts of the channels; also the construction of sea walls on Great and Little Rocks, Hogs Back, and Holmes Rock; estimated cost, \$5,139,120, '68, 741, 745; '70, 437; '71, 725; '72, 803; '74, ii, 164; '76, i, 243; '80, 479; '84, 690; '86, 95; '91, 900.

**EAST ROCKAWAY CREEK, N. Y.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 93.

**ENGINEER IN CHARGE.**

Capt. T. L. Casey, 1888. Report, '89, 840.

**Physical Characteristics.**

Description of the locality, '89, 841.

**Plans.**

In 1888 Capt. Casey did not consider the creek worthy of improvement, '89, 841.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. McC. Derby, '89, 840.

**ECHO HARBOR, NEW ROCHELLE, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 190.)

**Appropriations.**

1878-'82 ..... \$22,000

List of appropriations, '88, 571.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 54; '89, 66; '90, 60; '91, 74; '92, 79.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886-'—. Reports, '88, 570; '89, 717; '90, 652; '91, 804; '92, 706.

**ECHO HARBOR, NEW ROCHELLE, N. Y.—Continued.****Operations.**

1887-'89. Available funds insufficient to continue the projected work, '88, 571; '89, 718.

1889-'90. 9,122 cubic yards material dredged from the channel by hired labor, '90, 653.

1890-'92. No operations, '91, 805; '92, 707.

**Physical Characteristics.**

Description of the harbor, '88, 570.

**Projects.**

By Col. Newton, 1875, for removal of Sheepshead Reef and Start Rock to a depth of 9 and 6 feet, respectively. Modified, 1878, for removal of Start Rock to 7-foot depth; estimated cost, \$38,955.38, '76, 264; '86, 636; '87, 624; '92, 706.

**EDENTON BAY AND HARBOR, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 190.)

**Appropriations.**

1878-'87 ..... \$17,000

**Engineers.**

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1888. Report, '88, 773.

**Operations.**

1887-'88. No further operations required, '88, 773.

**Projects.**

By S. T. Abert, 1875, for improvement of Edenton Harbor and Bay by excavation of channel 850 yards long, 100 feet wide, and 9 feet deep; also a turning basin at the wharves; estimated cost, \$12,650, '79, 91, 696; '80, 121.

From 1878-'84 \$5,000 was appropriated and expended upon this project.

In 1883 Capt. Mercur proposed widening the channel to 150 feet at the outer and 200 feet at the inner end; also the completion of the turning basin with an area of about 12 acres; estimated cost, \$18,000, '84, 1073, 1074; '87, 122.

In 1888 Col. Craighill recommended no further appropriations, the harbor being amply sufficient for commercial requirements, '88, 774.

**EDISTO RIVER, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 191.)

**Appropriations.**

1882-'87 .....	\$16,000
1888 .....	5,000, '88, 987.
1890 .....	5,000, '90, 1208.
1892 .....	7,385, '92, 1234.

Total ..... 33,385

List of appropriations, '88, 987; '91, 1481.

**Commerce.**

Commercial prospects of the river, '88, 986. Prospective development of timber interests, '89, 1169.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 136; '89, 152; '90, 136; '91, 177; '92, 174.

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888— . Reports, '88, 985; '89, 1169, 2795; '90, 1206; '91, 1480; '92, 1233.

ASSISTANT.

J. P. Allen. Reports, '89, 1170; '90, 1208; '91, 1481; '92, 1234.

**Obstructions.**

Bridges obstructing navigation, '89, 2795.

**Operations.**

1887-'88. No operations for lack of funds, '88, 986.

1888-'89. 1,815 trees and stumps and 87 cords of snags removed from the channel, and 1,041 trees and 212 cords of brush cut from the banks, '89, 1169.



**EDISTO RIVER, S. C.—Continued.****Operations—Continued.**

1889-'90. 1,900 logs and trees and 106 cords of snags removed from the channel, and 1,705 trees removed from the banks, '90, 1208.

1890-'91. 640 stumps and snags cleared from the channel on the North Fork, and 1,200 snags and 485 trees from the channel and banks of the South Fork, '91, 1482.

1891-'92. 2,340 snags and 47 cords of small snags removed from the channel, and 1,733 trees and 378 cords of brush cleared from the banks, '92, 1234.

**Projects.**

By Col. Gillmore, 1880, for enlargement and clearance of channel, formation of new channels across necks of bends, shutting off lateral channels, and removal of logs, snags, and pile obstructions; also removal of sand and dry shoals, and construction of deflecting jetty; estimated cost, \$33,385, '81, 1140; '86, 180; '87, 1143; '92, 1233.

**EDISTO RIVER, S. C.—EXAMINATION OF NORTH FORK OF THE.****Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 138.

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888. Report, '88, 991.

ASSISTANTS.

Capt. T. N. Bailey. Report, '88, 993.

Lieut. O. M. Carter. Report, '88, 993.

**Physical Characteristics.**

Description of the river, '88, 992, 993.

**Plans.**

Col. Gillmore reports that in view of the limited amount of commerce to be benefited, the North Fork of the Edisto River is not worthy of improvement, '88, 992.

**Surveys.**

Examination ordered by act of July 5, 1884. Made, 1884, under direction of Col. Gillmore, '88, 991.

**EDISTO RIVER, S. C., North and South Forks.—EXAMINATION TO CONNECT BY SAINT PIERRE RIVER AND SOUTH CREEK.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 158.

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888. Report, '89, 1208.

**Physical Characteristics.**

Description of the locality, '89, 1208.

**Plans.**

In 1889 Capt. Abbot did not consider the locality worthy of improvement, '89, 1210.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Abbot, '89, 1208.

**EEL RIVER, CAL.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 352.

ENGINEER IN CHARGE.

Maj. W. H. Heuer, 1888. Report, '89, 2493.

**Physical Characteristics.**

Description of the locality, '89, 2493.

**Plans.**

In 1888 Maj. Heuer did not consider the river worthy of improvement, '89, 2495.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Heuer, '89, 2493.

**ELIZABETH RIVER, VA., Western Branch.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 153, 1307.

ENGINEER IN CHARGE.

Lieut. G. J. Fiebeger, 1890. Report, '91, 1308.

**Physical Characteristics.**

Description of the locality, '91, 1308.

**Plans.**

In 1890 Lieut. Fiebeger did not consider that the present or prospective needs of commerce demanded any improvement. '91, 1309.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Fiebeger, '91, 1308.

**ELIZABETH RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 192.)

**Appropriations.**

1879-'82 .....	\$27, 000
1890 .....	5, 000, '90, 853.
1892 .....	5, 000, '92, 879.

Total .....	37, 000
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List of appropriations, '90, 853.

**Commerce.**

Prospective benefit to commerce from improvement, '88, 649.

**Contracts.**

1891. R. Parrott, for dredging, at 55 cents per cubic yard, '91, 994.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 69; '89, 89; '90, 79; '91, 100; '92, 103.

ENGINEERS IN CHARGE.

Capt. G. McC. Derby, 1886-'89. Report, '88, 648.

Capt. T. L. Casey, 1889-'— . Reports, '89, 827; '90, 852; '91, 993; '92, 878.

**Operations.**

1887-'90. No operations, '88, 648; '89, 827; '90, 852.

1890-'91. Excavation of channel begun, '91, 993.

1891-'92. 6,917 cubic yards material dredged, '92, 879.

**Physical Characteristics.**

Description of the river and its deterioration since the suspension of work, '88, 648, 649.

**Projects.**

By Col. Macomb, 1879, for dredging a channel 60 feet wide to a depth of 7 feet at mean high water from the mouth to Broad Street Bridge, 2.7 miles, requiring the removal of 44,000 cubic yards of material; estimated cost, \$25,530, '79, 67, 482, 483.

Estimate increased, in 1881, by Lieut. Col. Michler, to \$43,160, from increased cost of dredging, '81, 707; '87, 768; '92, 879.

**ELK RIVER, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 193.)

**Appropriations.**

1874-'87 .....	\$31, 500
1890 .....	10, 000, '91, 1185.
1892 .....	5, 000, '92, 969.

Total .....	46, 500
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List of appropriations, '91, 1184.

**ELK RIVER, MD.—Continued.****Contracts.**

1891. C. T. Caler, for dredging, at 12½ cents per cubic yard, '91, 1185.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 112; '90, 102; '91, 125; '92, 125.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1888-'— Reports, '90, 965; '91, 1184; '92, 968.

ASSISTANT.

A. Stierle. Report, '90, 965.

**Operations.**

1890-'91. No operations, '91, 1184.

1891-'92. 56,069 cubic yards material dredged, '92, 968.

**Physical Characteristics.**

Description of the locality, '90, 966.

**Projects.**

By Mr. W. F. Smith, 1890, for excavation of a channel, from the upper wharves at the bridge to below Cedar Point, to a depth of 8 feet at mean low water and 100 feet wide; estimated cost, \$24,000, '91, 1184.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Mr. W. F. Smith, '90, 966.

**ELK RIVER, W. VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 193.)

**Appropriations.**

1875-'87 .....	\$18,500
1888 .....	3,000, '88, 1760.
1890 .....	2,500, '90, 2248.
1892 .....	2,500, '92, 2064.

Total .....	26,500
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**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 224; '89, 260; '90, 234; '91, 300; '92, 287.

ENGINEERS IN CHARGE.

Col. W. P. Craighill, 1876-'— Reports, '88, 1760; '90, 2247; '91, 2427; '92, 2064.

Capt. T. Turtle, 1889. Report, '89, 1955.

ASSISTANTS.

W. A. Porter. Report, '89, 1956.

A. M. Scott. Report, '92, 2064.

**Operations.**

1887-'88. No operations, '88, 1760.

1888-'89. 5,471 cubic yards rock blasted and removed from the channel, '89, 1958.

1889-'90. No operations, '90, 2247.

1890-'91. 153 snags and 18 rocks removed from the channel, '91, 2427.

1891-'92. 4,418 cubic yards rock blasted and removed in the upper river; 2,460 cubic yards rock and 7,670 linear feet of round timber used in dike construction at points below Clay Court-House, '92, 2065, 2066.

**Projects.**

By Maj. Craighill, 1875, for an improvement of channels through shoals, to a depth of 10 or 12 inches at low water, by cutting sluice ways 12 feet wide; also the removal of rocks, snags, and overhanging trees; estimated cost, \$100,000, '76, ii, 166, 171; '79, 555; '80, 691; '81, 147; '85, 286.

Injurious effect of corporate lock and dam at Charleston, '82, 932, 934; '83, 147; '85, 1858. Act providing for its removal, '87, 1923.

**ENTRANCE TO CUMBERLAND SOUND, FLA. AND GA.—(See CUMBERLAND, GA., IMPROVEMENT OF ENTRANCE.)**

**ERIE HARBOR, PA.—IMPROVEMENT OF.**

(See also PRESQUE ISLE, PA.)

(Continued from Vol. II, p. 195.)

**Appropriations.**

1823-'87 .....	\$768,867.23
1888.....	23,000.00, '88, 2023.
1890.....	40,000.00, '90, 2797.
1892.....	40,000.00, '92, 2525.
Total .....	871,867.23

**Contracts.**

1888. J. L. Linn, for dredging, at 28 cents per cubic yard, '89, 2347. O. Gillmore, for dredging, at 28 cents per cubic yard, '89, 2347.  
 1890. Hingston & Wood, for dredging, at 18½ cents per cubic yard, '90, 2792. Benham & Doville, for transportation of material, '90, 2793.  
 1891. J. B. Donnelly, for pier extension, at \$61 per linear foot, '91, 2876.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 277; '89, 328; '90, 297; '91, 373; '92, 352.

**ENGINEERS IN CHARGE.**

Capt. F. A. Mahan, 1886-'90. Reports, '88, 2017; '89, 2343.

Maj. A. Stickney, 1890-'92. Reports, '90, 2789; '91, 2869.

Maj. E. H. Ruffner, 1892-'—. Report, '92, 2522.

**Operations.**

- 1887-'88. General repairs by hired labor to piers and breakwater, '88, 2021.  
 1888-'89. 10,700 cubic yards material dredged; steam launch and boathouse built; minor repairs to piers and breakwater, '89, 2347, 2349.  
 1889-'90. Two breaches in breakwater repaired by hired labor; minor repairs to breakwater and piers; 20,000 cubic yards material dredged, '90, 2792, 2793.  
 1890-'91. Repairs to south breakwater and north pier; 125,471 cubic yards material dredged from inner and outer channels, '91, 2870.  
 1891-'92. 2,800 cubic yards material dredged in outer channel; north pier extended 452 feet; repairs to breakwater and piers, '92, 2522.

**Physical Characteristics.**

Description of the locality, '88, 2022.

**Projects.**

Projects for this improvement from its inception in 1823 have been directed to the formation of a harbor in Presque Isle Bay, with a protected channel across the entrance to the bay. The aggregate appropriations, including 1886, have been \$768,867.23.

In 1886 Capt. Maguire estimated that \$84,120 would be required to extend the pier to the 16-foot curve and maintain a channel 16 feet deep between the harbor and deep water in the lake, '86, 339.

In 1890 the project was modified by Maj. Stickney, for extension of the north pier to the 18-foot curve, at an estimated cost of \$96,000, making the revised estimate for completion, including the appropriation of 1890, \$47,657, '90, 2796, 2797.

**Surveys.**

Survey of Presque Isle Peninsula. Made, 1888, under direction of Capt. Mahan, '88, 2021; '89, 2346.

**ESCAMBIA AND CONECH RIVERS, ALA. AND FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 196.)

**Appropriations.**

1833-'87 .....	\$62,500
1888.....	10,000, '88, 1170.
1890.....	7,500, '90, 1636.
1892.....	8,000, '92, 1418.

Total ..... 88,000

List of appropriations, '88, 1169; '91, 1736.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 153; '89, 149; '90, 161; '91, 203; '92, 199.

**ESCAMBIA AND CONECUH RIVERS, ALA. AND FLA.—Cont'd.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1169.

Capt. P. M. Price, 1889-'— Reports, '89, 1384; '90, 1634; '91, 1736; '92, 1417.

**ASSISTANT.**

J. E. Turtle. Reports, '89, 1384; '90, 1635.

**Operations.**

1887-'88. 2,998 logs and snags removed from the channel, '88, 1170.

1888-'89. Removal of logs, snags, and similar obstructions, '89, 1385.

1889-'90. 530 snags and 153 cubic yards rock and gravel removed from the channel, 20 trees cut from the banks, and 2,353 cubic yards sand dredged, '90, 1636.

1890-'91. Repairs to snagging plant, '91, 1736.

1891-'92. 3,523 snags cleared from the channel, 19 cubic yards gravel dredged, and 1,105 logs on banks cut up, '92, 1417.

**Projects.**

By Capt. Damrell, 1879, for the improvement of the Escambia River from mouth to State line by dredging a channel 150 feet wide and 5½ feet deep at mean low water through the bar at the mouth, the removal of snags and similar obstructions, and by shore protection and wing-dam construction to obtain a 5-foot low-water channel throughout the length of the river; estimated cost, \$25,000, '79, 853, 856; '80, 1082.

In 1882 \$12,000 was appropriated for the Escambia and Conecuh rivers, when it was proposed to extend navigation to Indian Creek, 273 miles above the mouth of the river, by removal of obstructions, closing cut-off, and rock removal, at an additional estimated cost of \$62,430 over the estimate of 1879, '83, 1007; '87, 1273. Total estimated cost of improvement, \$87,430, '88, 1169.

**ESSEX RIVER, MASS.—SURVEY OF.****Appropriations.**

1892..... \$5,000

**Commerce.**

Commercial interests to be influenced by improvement, '91, 677.

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 47.

**ENGINEER IN CHARGE.**

Lieut. Col. S. M. Mansfield, 1890. Report, '91, 676, 677.

**ASSISTANT.**

T. T. Hunter Harwood. Report, '91, 678.

**Physical Characteristics.**

Description of the locality, '91, 678.

**Plans.**

By Lieut. Col. Mansfield, 1891, for a channel 4 feet deep at mean low water and 60 feet wide from the river's mouth to the head of navigation at Essex, a distance of 3¼ miles, by dredging and rock removal, at an estimated cost of \$25,000, '91, 677.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Mansfield, '91, 677.

**MAPS.**

'91, 678.

**FAIRLEE CREEK, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 198.)

**Appropriations.**

1888..... \$5,000, '88, 92.

1890..... 5,000, '90, 936.

Total ..... 10,000

**Contracts.**

1889. C. T. Caler, for dredging, at 23 cents per cubic yard, '89, 899.

1891. C. T. Caler, for dredging, at 16 cents per cubic yard, '91, 1187.

**FAIRLEE CREEK, MD.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 92; '89, 109; '90, 99; '91, 126; '92, 126.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1886-'— Reports, '89, 898; '90, 936; '91, 1186; '92, 969.

**Operations.**

1887-'88. No operations, '88, 92.

1888-'89. 18,500 cubic yards material dredged, '89, 898.

1889-'90. No operations, '90, 936.

1890-'91. 28,125 cubic yards material dredged, '91, 1186.

1891-'92. No operations, '92, 969.

**Projects.**

By W. F. Smith, 1887, for excavation of a channel across the bar at the mouth of the creek 7 feet deep and 100 feet wide; estimated cost, \$15,450, '87, 856; '91, 1187; '92, 970.

**FAIRPORT HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 198.)

**Appropriations.**

1825-'87 .....	\$280, 873. 53
1888.....	10, 000. 00, '88, 2012.
1890.....	30, 000. 00, '90, 2783.
1892.....	35, 000. 00, '92, 2506.

Total ..... 355, 873. 53

List of appropriations, '92, 2507.

**Contracts.**

1888. B. S. Harton, for pier extension and repair, at a total of \$6,144, '89, 2398.

1889. Q. Gillmore, for dredging, at 25 cents per cubic yard, '89, 2328.

1890. J. R. Irwin, for dredging, at 23 cents per cubic yard, '90, 2781. American Transportation Company, for dredging, at 17½ cents per cubic yard, '91, 2862.

Q. Gillmore, for pier extension and repair, at a total of \$14,724, '91, 2862.

1891. J. R. Irwin, for dredging, at 17½ cents per cubic yard, '92, 2507.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 275; '89, 326; '90, 295; '91, 371; '92, 350.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1883-'92. Reports, '88, 2011; '89, 2326; '90, 2781; '91, 2859.

Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2506.

**Operations.**

1887-'88. East pier extended 200 feet under contract, '88, 2012.

1888-'89. 8,240 cubic yards material dredged from between the piers; west pier extension begun, '89, 2326.

1889-'90. West pier extension completed; 3,000 cubic yards material dredged, '90, 2781.

1890-'91. 42,001 cubic yards material dredged; 3 cribs sunk in extension of west pier, '91, 2860.

1891-'92. 51,353 cubic yards material dredged, '92, 2506.

**Projects.**

By Capt. Maurice, 1825, for removal of bar at mouth of river by construction of parallel piers 200 feet apart, extending out to a depth of 10 feet; the west pier to be longer than the east and to flare to the westward; estimated cost, \$26,997.81, '80, 2147. For extension and changes in original project, see history of work, '80, 2147.

In 1879 the west pier had reached a total length of about 1,060 feet, and the east pier 1,250, '81, 2320.

By Maj. Wilson, 1880, for extension of the west pier 500 feet and east pier 600 feet, renewal of superstructure, and dredging in channel to maintain a depth of 15 feet at harbor entrance; estimated cost, \$80,300, '80, 2153. Increased, in 1882, to \$93,000, '82, 2407; '87, 2325.

In 1890 Maj. Overman proposed the formation of an increased depth of 18 feet by extension of both piers lakeward 600 feet, with dredging between the piers, beyond their ends, and in Grand River; estimated cost, \$114,400, '90, 2782.

**Surveys.****MAPS.**

'91, 2861.

**FALLS OF SAINT ANTHONY, Mississippi River.**—(See MISSISSIPPI RIVER, PRESERVATION OF THE FALLS OF SAINT ANTHONY.)

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**FALSE PRESQUE ISLE HARBOR, LAKE HURON, MICH.,**  
**Harbor of Refuge at.**—EXAMINATION OF.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 319.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1888. Report, '89, 2276.

**Plans.**

In 1888 Col. Poe did not consider the locality worthy of improvement by the General Government, '89, 2277.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2276.

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**FEATHER RIVER, CAL.**—(See SACRAMENTO AND FEATHER RIVERS.)

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**FISHING CREEK, N. C.**—IMPROVEMENT OF.

**Appropriations.**

1890.....	\$10,000, '91, 1346.
1892.....	5,000, '92, 1118.

Total .....	15,000
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**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 149; '90, 133; '91, 156; '92, 157.

ENGINEERS IN CHARGE.

Capt. W. H. Bixby, 1888-'92. Reports, '90, 1179, 1181; '91, 1345.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1117.

**Obstructions.**

Bridges obstructing navigation, '91, 1346.

**Operations.**

1890-'91. Commencement of operations postponed pending alteration of bridges spanning the creek, '91, 1345; '92, 1117.

**Physical Characteristics.**

Description of the locality, '90, 1180.

**Projects.**

By Capt. Bixby, 1889, for improvement of the creek, from its mouth up to Bellamy's Mill, by removal of logs, snags, and similar obstructions, at an estimated cost of \$25,000, '90, 1181; '91, 1345.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '90, 1179.

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**FISHING PLACE COVE, near Seaconnet Point, R. I.**—EXAMINATION FOR CONSTRUCTION OF BREAKWATER AT.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 55.

ENGINEER IN CHARGE.

Maj. W. R. Livermore, 1888-'89. Report, '89, 649.

**Physical Characteristics.**

Description of the locality, '89, 649.

**FISHING PLACE COVE, near Seaconnet Point, R. I.—Cont'd.****Plans.**

By Maj. Livermore, 1888, for restoration of existing breakwater and dredging an anchorage area inside the cove; estimated cost, \$5,000, '89, 649.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Livermore, '89, 649.

**FIVE-MILE RIVER HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 201.)

**Appropriations.**

1888.....	\$5,000, '88, 52.
1890.....	5,000, '90, 647.
1892.....	5,000, '92, 698.

Total ..... 15,000

**Contracts.**

1889. R. Parrott, for hire of dredging plant, at \$8.50 per hour, '89, 711.

1891. G. B. Beardsley, for dredging, at 14.6 cents per cubic yard, '91, 794.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 52; '89, 65; '90, 58; '91, 72; '92, 76.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886'—. Reports, '89, 710; '90, 646; '91, 792; '92, 697.

**Operations.**

1887-'88. No operations, '88, 52.

1888-'89. 10,976 cubic yards material dredged, '89, 711.

1889-'90. 11,962 cubic yards material dredged, '90, 647.

1890-'91. No operations, '91, 793.

1891-'92. 30,000 cubic yards material dredged, '92, 698.

**Physical Characteristics.**

Description of the locality, '89, 710.

**Projects.**

By Col. Houston, 1886, for deepening the harbor and approaches by a channel 100 feet wide, 8 feet deep at mean low water, and 6,000 feet long; estimated first cost, \$25,000, with \$1,000 for annual maintenance, '87, 641; '89, 710; '92, 697.

**FLINT RIVER, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 201.)

**Appropriations.**

1878-'87.....	\$117,000
1888.....	20,000, '88, 1177.
1890.....	20,000, '90, 1639.
1892.....	15,000, '92, 1404.

Total ..... 172,000

List of appropriations, '88, 1176; '89, 1386.

**Commerce.**

Increase in river business due to improvement, '88, 1178.

**Contracts.**

1888. M. A. Sweeney & Bro., for snag boat, dumping flat, and drilling barge, at \$4,800, \$600, and \$3,400 respectively, '89, 1389.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 155; '89, 180, 185; '90, 161; '91, 198; '92, 194.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1175.

Capt. P. M. Price, 1889'—. Reports, '89, 1385, 1420; '90, 1637; '91, 1698; '92, 1402.

**ASSISTANT.**

T. Robinson. Reports, '89, 1387, 1422; '90, 1638; '91, 1699; '92, 1403.



**FLINT RIVER, GA.—Continued.****Operations.**

- 1887-'88. 585 snags and trees and 5,325 cubic yards rock removed from the river, '88, 1177.  
 1888-'89. 450 snags, 1,815 cubic yards solid rock, and 817 cubic yards bowlders and loose rock removed from the channel, and 1,461 trees cut from the banks, '89, 1388.  
 1889-'90. 980 snags, 1,412 cubic yards rock, ferry-boat wreck, and steamer's boiler removed from the channel, '90, 1638, 1639.  
 1890-'91. 320 snags and 15 cubic yards rock removed from the channel, and 1,723 trees cleared from the banks, '91, 1699.  
 1891-'92. 2,229 snags and 3,203 cubic yards of rock removed from the channel; 2,160 trees cleared from the banks, '92, 1403.

**Plans.**

- In 1889 Capt. Price considered it advisable to postpone removal of the rock reefs at Albany until the completion of the improvement above, '89, 1421.

**Projects.**

- By Capt. Damrell, in 1873, modified in 1880 after more detailed surveys, for low-water navigable channel 3 feet deep and 100 feet wide from mouth of river to Albany, Ga., a distance of 105 miles, and a navigable channel for light-draft steamers, at moderate stages of water, from Albany to Montezuma, a distance of 100 miles, to be secured by removal of snags, scouring bars, by works of contraction, and cutting through rock reefs; estimated cost, \$199,962, '73, 707, 721; '80, 1073; '86, 1162; '87, 1278; '91, 1700.

**Surveys.**

- Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Price, '89, 1420.

**FLUSHING BAY, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 202.)

**Appropriations.**

1879-'87 .....	\$70,000
1888.....	15,000, '88, 582.
1890.....	20,000, '90, 666.
1892.....	10,000, '92, 724.

Total ..... 115,000

List of appropriations, '88, 582.

**Contracts.**

1889. J. & A. DuBois, for pile dike construction, at \$45.09½ per 10 linear feet, and for dredging, at 20 cents per cubic yard, '89, 732.  
 1891. C. & H. E. DuBois, for dredging, at 18 cents per cubic yard, '91, 823.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 56; '89, 69; '90, 62; '91, 77; '92, 82.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886—'. Reports, '88, 581; '89, 730; '90, 664; '91, 822; '92, 722.

**Operations.**

- 1887-'88. 23,630 cubic yards material dredged from channel and shoals, '88, 581.  
 1888-'89. 375 piles driven, '89, 731.  
 1889-'90. 1,606 linear feet of dike built, and 15,063 cubic yards material dredged, '90, 665.  
 1890-'91. 4,515 cubic yards of riprap stone placed upon the dike, '91, 823.  
 1891-'92. 73,849 cubic yards material dredged, '92, 723.

**Physical Characteristics.**

Description of the bay; rise of tide, '88, 541.

**Projects.**

- By Lieut. Col. Newton, 1879, for the formation of a tidal basin by dredging, and an inclosing pile dike with an opening near the head of the bay, which, by filling and discharging through the main channel, would maintain a depth of 6 feet at mean low water; estimated cost, \$173,500, '79, 62, 385, 387; '86, 661; '87, 634; '92, 722.

**Surveys.****MAPS.**

'89, 732.

**FOND DU LAC RIVER, WIS.—SURVEY FOR HARBOR AT MOUTH OF.****Commerce.**

Present and prospective commercial importance of the harbor, '90, 2393.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 287; '90, 259.

ENGINEER IN CHARGE.

Maj. C. E. L. B. Davis, 1888. Report, '90, 2389, 2390.

**Plans.**

By Maj. Davis, 1889, for excavation of a channel 100 feet wide from the Scott Street Bridge to the north ice-house, and 150 feet wide thence to the lake, with a depth of 7 feet; estimated cost, \$8,000, '90, 2393.

**Surveys.**

Survey ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Davis, '90, 2390.

**FORESTVILLE HARBOR, MICH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 319.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1888. Report, '89, 2288.

**Plans.**

In 1888 Col. Poe did not consider the locality worthy of improvement by the General Government, '89, 2282.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2282.

**FORKED DEER RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 171.)

**Appropriations.**

1882-'87. South Fork.....	\$10, 000	
1888. { South Fork.....	2, 500	'89, 1621.
{ North Fork below Dyersburg....	4, 500	
{ Main river below Dyersburg....	2, 500	
1890 .....	2, 500,	'90, 1908.
1892 .....	3, 000,	'92, 1662.
Total .....	25, 000	

List of appropriations, '91, 2013; '92, 1661.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 183; '89, 215; '90, 194; '91, 246; '92, 239.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1886-'—. Reports, '88, 1369; '89, 1621; '90, 1906; '91, 2012; '92, 1660.

**Obstructions.**

Obstruction of South Fork by bridges without draws, '89, 1623.

**Operations.**

1887-'88. No operations, '88, 1369.

1888-'89. 550 snags, 1 wreck, and 92 log jams removed from the channel; 1,635 trees and snags and 2,180 square yards brush cleared from the banks, and 100 linear feet brush dam built on South Fork; 1,452 snags and 1 wreck removed from channel; 1,605 trees and shore snags and 9,260 square yards brush cleared from the banks on North Fork below Dyersburg; 79 shore snags and side jams removed; 528 trees and 500 square yards brush cleared from banks on main river, '89, 1622, 1623.

1889-'90. 274 snags and logs removed from the channel; 2,675 trees and 475 square yards brush cleared from the banks on the main river; 362 snags and 285 shore snags and trees cleared from North Fork, completing projected improvement; no operations on South Fork, '90, 1907.

**FORKED DEER RIVER, TENN.—Continued.****Operations—Continued.**

1890-'91. No operations, '91, 2013.

1891-'92. Operations confined to North Fork and main river; 660 stumps and snags and 6 log jams removed; 1,300 trees cut and topped on the banks, '92, 1662.

**Physical Characteristics.**

Description of the river, '90, 1906.

**Projects.**

By Maj. Benyaard, 1880, for removal of snags and similar obstructions, and clearing the banks of South Fork from Sharon to the mouth, a distance of 114 miles; estimated cost, \$19,250, '81, 1491; '87, 202. Operations subsequently extended to Jackson, the head of navigation, 81 miles above Sharon. Improvement not considered permanent, '88, 183, 1369; '90, 1906.

By Capt. Willard, 1887, for improvement of the main river from its mouth to the junction of the North and South Forks, a distance of 29 miles, by removal of logs, snags, and similar obstructions; estimated cost, \$7,000; also for a similar improvement of the North Fork up to Dyersburg, a distance of 9 miles, at an estimated cost of \$4,500, '87, 1484, 1495; '89, 1621; '90, 1906.

**FORT MARION, FLA.—REPAIRS AND PRESERVATION OF.****Appropriations.**

1890..... \$15,000, '91, 535.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 11; '92, 15.

ENGINEERS IN CHARGE.

Capt. W. M. Black, 1891-'92. Report, '91, 533.

Maj. J. C. Mallery, 1892. Report, '92, 471.

**Operations.**

1890-'91. Repairs to existing works; 292 linear feet of concrete sea wall built, '91, 534.

1891-'92. Repairs to existing works, '92, 472.

**FORT MONROE, VA., Iron pile bridge at.—ACROSS MILL CREEK.****Appropriations.**

1889..... \$20,000, '89, 466.

**Contracts.**

1889. Groton Bridge and Manufacturing Company, for bridge construction, at \$17,500, '90, 387.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 12; '90, 9.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1889-'90. Reports, '89, 465; '90, 387.

**Operations.**

1889-'90. Construction of bridge under contract completed, '90, 387.

**Plans.**

Description of proposed structure, '89, 466.

**FORT MONROE, VA.—WHARF AT.****Appropriations.**

1887..... \$100,000

1888..... 75,000, '89, 465.

Total ..... 175,000

**Contracts.**

1887. Groton Bridge and Manufacturing Company, for wharf construction, at a total of \$88,305, '88, 806.

1889. Darden & Ashe, for storehouse construction, at \$7,440, '90, 386.

**FORT MONROE, VA., wharf at—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 107; '89, 12; '90, 9; '91, 10.

**BOARD OF ENGINEERS.**

Convened by S. O. No. 268, November 17, 1886, to select and report upon site and plan for wharf at Fort Monroe. Report, '88, 805. (Col. Tidball and Lieut. Cols. Chandler and Hains.)

**ENGINEER IN CHARGE.**

Lient. Col. P. C. Hains, 1887-'—. Reports, '88, 804; '89, 463; '90, 385; '91, 529.

**Operations.**

1887-'88. Delivery of piles and material for construction completed, '88, 806.

1888-'89. Wharf construction begun, '89, 464.

1889-'90. Wharf completed, '90, 386.

1890-'91. Construction of pile jetty in progress, '91, 530.

**Plans.**

Description of wharf, '88, 805; '89, 464.

**FORT NIAGARA, N. Y.—PROTECTION OF SITE OF.****Appropriations.**

1890 (allotment)..... \$10,000, '91, 519.

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 8.

**ENGINEER IN CHARGE.**

Capt. D. C. Kingman, 1890. Report, '91, 517.

**Operations.**

1890-'91. Repairs to lake-front revetment; crib-work base for northwest angle of the breakwater completed; cofferdam built and northwest angle of fort wall rebuilt, '91, 519.

**Projects.**

By Maj. Adams, 1888, for repair of the sea wall along the lake front, the construction of dikes of fascines, iron pickets, and stone along the river and a portion of the lake front, and the filling in behind these dikes to a height of 6 feet above low water, leaving a flat slope down to the water, then a suitable roadway, then a steeper slope to the general level of the site, to protect the lower slope by a growth of willows, and the upper slope by sod; estimated cost, \$44,416, '91, 518.

**FORT POND HARBOR, MONTAUK, N. Y.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 70.

**ENGINEER IN CHARGE.**

Lient. Col. D. C. Houston, 1888. Report, '89, 733.

**Physical Characteristics.**

Description of the locality, '89, 733.

**Plans.**

In 1888 Lient. Col. Houston did not consider the harbor worthy of improvement in view of the present and prospective demands of commerce, '89, 736.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lient. Col. Houston, '89, 733.

**FOURCHE LA FEVE RIVER, ARK.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 204.)

**Appropriations.**

1879-'87 .....	\$26,000
1890.....	7,500, '90, 1942.

Total .....	33,500
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8648—12

**FOURCHE LA FEVE RIVER, ARK.—Continued.****Commerce.**

Commercial interests to be subserved by improvement, '91, 2045.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 188; '89, 221; '90, 199; '91, 251; '92, 243.

**ENGINEER IN CHARGE.**

Capt. H. S. Taber, 1886-'— Reports, '88, 1402; '89, 1654; '90, 1941; '91, 2044; '92, 1681.

**Operations.**

1887-'88. Channel completed through shoal below Perryville, '88, 1402.

1888-'90. No operations, '89, 1654; '90, 1941.

1890-'91. Snag boat built, '91, 2044.

1891-'92. 1,326 snags and stumps, 4 drift piles, and 923 cubic yards rock and gravel removed from the channel, and 15,600 overhanging trees cleared from the banks, '92, 1682.

**Projects.**

By Maj. Benyaurd, 1879, for the removal of snags, bowlders, and leaning trees, at an estimated cost of \$23,034.50, '79, 972; '81, 1435.

After the expenditure of \$26,000 upon this project, Capt. Taber proposed the excavation of a channel through certain rock shoals below Perryville, at an estimated cost of \$7,650, '89, 1655.

**FOX AND WISCONSIN RIVERS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 204.)

**Appropriations.**

1839-'87 .....	\$3,027, 831.07
1888.....	100,000.00, '88, 1872.
1890.....	100,000.00, '90, 2369.
	*156,552.70
1892.....	75,000.00, '92, 2217.
	†109,023.33

Total ..... 3,568,407.10

List of appropriations, '92, 2216.

**Commerce.**

Effect of improvement upon freight rates, '88, 1872.

**Contracts.**

1889. S. A. Harrison, for levee construction, at a total of \$7,306, '90, 2366.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 245, 247; '89, 284, 286; '90, 257, 258; '91, 328, 329; '92, 314, 315.

**ENGINEERS IN CHARGE.**

Capt. W. L. Marshall, 1884-'89. Report, '88, 1869, 1878.

Maj. C. E. L. B. Davis, 1889-'92. Reports, '89, 2085, 2095; '90, 2365, 2378; '91, 2572, 2580.

Maj. J. F. Gregory, 1892-'— Report, '92, 2213, 2222.

**ASSISTANTS.**

C. A. Fuller. Reports, '88, 1872; '89, 2088; '90, 2369.

S. Whitney. Reports, '91, 2572, 2581; '92, 2217.

**Operations.****FOX RIVER.**

1887-'88. 161,747 cubic yards material dredged from bars on the Upper Fox; 63,148 cubic yards gravel and sand dredged from channel on the Lower Fox; repair and construction of locks and dams; repair of boats and dredges, '88, 1870, 1877.

1888-'89. 140,882 cubic yards material dredged from bars on the Upper Fox; 10,883 cubic yards material dredged from Menasha River; extensive repairs to dredging plant and tug boats; construction of Appleton Lower Dam continued; extensive repairs to Rapid Croche and Menasha locks, '89, 2085.

1889-'90. Levee at Portage built under contract; new lower dam at Appleton completed; 25,000 cubic yards material dredged; operation, care, and repair of locks, dams, and canals, '90, 2366-2376.

\* Land damages and Commissioner's salary.  
† Flowage damages.

**FOX AND WISCONSIN RIVERS—Continued.****Operations—Continued.****FOX RIVER—Continued.**

1890-'91. Construction of guard gates beyond at head of Kaukauna Canal; head wall and feeder built at head of old first lock at Appleton; brush and stone wing dam built at Portage Levee, '91, 2573. 38,214 cubic yards of material dredged in Lower Fox, Neenah Channel, and mouth of Fond du Lac River, '91, 2578. Construction and repair of plant; operation and care of locks and dams, '91, 2580, 2587.

1891-'92. Guard gates at head of Kaukauna Canal completed; 3,117 cubic yards of rock blasted and removed, and 1,110 cubic yards of material dredged from rock bar at river outlet of De Pere Lock; 80,145 cubic yards of material dredged at points on the Lower Fox; 13,577 cubic yards of material dredged on Fox River, between De Pere and Green Bay; buoy construction and repairs to plant, '92, 2217, 2219; operation and care of locks and dams, '92, 2222.

**Projects.**

The permanent works for the improvement of the Fox and Wisconsin rivers were purchased by the United States, in 1872, from the Green Bay and Mississippi Canal Company for \$325,000, '72, 35; '73, 219. The subsequent project proposed slack-water navigation of the Fox River by replacing the temporary structures with permanent works, and the construction of 5 additional locks on the Upper Fox; the improvement of the Wisconsin River by wing dams and dikes, so as to obtain throughout a depth of 6 feet for a width of 100 feet; estimated cost, \$3,745,663, '75, i, 218; '78, 1170; '80, 1952; '87, 270.

By Board of Engineers, 1884, for reconstruction of dam at Menasha, below site of present dam, across full width of Menasha Channel, and enlargement of Neenah Channel by dredging; also for purchase of lands and structures, '85, 2044; '86, 1689.

The Board of Engineers of 1886 decided against further attempts to improve the low-water navigation of the Wisconsin River by wing dams, '87, 2096.

**Surveys.**

Survey of Fox River, between De Pere and Green Bay. Made, 1888, under direction of Maj. C. E. L. B. Davis, '88, 2086.

**MAPS.**

'90, 2366.

**FRANKFORD CREEK, PA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 207.)

**Appropriations.**

1882..... \$10,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 77.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert, 1885. Report, '88, 698.

**Operations.**

1887-'88. No operations, '88, 698.

**Plans.**

Col. Robert reported, in 1888, that he did not consider the commercial interests of the creek warranted further appropriations for improvement, '88, 698, 699.

**Projects.**

By Capt. W. Ludlow, 1882, for excavation of a channel from the mouth of the creek to Frankford Avenue Bridge, having a low-water depth of 7 feet at the mouth, decreasing to 3 feet at the bridge, with a bottom width of 50 feet; estimated cost, \$40,000, '82, 823. No further operations recommended, '84, 811; '87, 799.

**FRANKFORT HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 207.)

**Appropriations.**

1866-'87 .....	\$255,659.85
1888 .....	8,000.00, '88, 1902.
1890 .....	10,000.00, '90, 2612.
1892 .....	10,000.00, '92, 2320.

Total ..... 283,659.85

List of appropriations, '92, 2319.

**FRANKFORT HARBOR, MICH.—Continued.****Contracts.**

1889. Truman & Cooper, for breakwater construction, at a total of \$8,081.58, '89, 2168.

1891. Gaylord & Wing, for timber, plank, and hemlock, at \$18, \$15, and \$10 per M feet, B. M.; G. W. Crouter, for bolts, spikes, and nails, at 3 cents per pound; F. A. Hagen, for stone, at \$2.24 per cord, '91, 2675.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 252; '89, 294; '90, 265; '91, 337; '92, 322.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1901.

Maj. W. Ludlow, 1889-'— . Reports, '89, 2167; '90, 2612; '91, 2674; '92, 2318.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1902.

1888-'89. No operations, '89, 2167.

1889-'90. South pier extended 100 feet, '90, 2612.

1890-'91. 3,900 cubic yards material dredged, '91, 2674.

1891-'92. 22,770 cubic yards material dredged; repairs to piers and revetment, '92, 2318.

**Projects.**

By Col. Cram, 1866, for dredging a new outlet through the strip of land separating Lake Aux Becs Scies from Lake Michigan, and building two parallel piers 200 feet apart, extending from 12-foot soundings in the inner lake to same depth in Lake Michigan; estimated cost, \$88,541, '66, i, 34, 36. Amended in 1875 and in 1879 to \$254,196, '81, 2201; '87, 2179.

By Maj. Harwood, 1881, for completion of improvement by dredging and 550 linear feet of pier extension; estimated cost, \$100,000, '81, 2201.

**FRENCH BROAD RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 209.)

**Appropriations.**

1880-'87 .....	\$28,000
1888 .....	10,000, '88, 1603.
1890 .....	10,000, '90, 2129.
1892 .....	15,000, '92, 1924.

Total ..... 63,000

List of appropriations, '90, 2128.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 208; '89, 243; '90, 219; '91, 280; '92, 268.

ENGINEERS IN CHARGE.

Lieut. Col. J. W. Barlow, 1886-'92. Reports, '88, 1602; '89, 1831; '90, 2127; '91, 2261.

Lieut. Col. H. M. Robert, 1892-'—. Report, '92, 1922.

**Operations.**

1887-'88. 37 snags, 112 cubic yards solid and loose rock, and 650 cubic yards of earth removed from the channel; 1,726 cubic yards riprap quarried, and 1,072 cubic yards riprap placed in spur dams; work done by hired labor, '88, 1602.

1888-'89. 40 snags and 1,977 cubic yards rock and gravel removed from the channel; 1,734 cubic yards riprap placed in dams, '89, 1832.

1889-'90. 1,433 cubic yards rock and gravel excavated, 240 trees cut from the banks, 104 linear feet of coffer dam built, 240 cubic yards riprap quarried, and 1,523 cubic yards of same built into dams, '90, 2129.

1890-'91. 195 cubic yards loose rock removed from the channel at Bryants Shoals; 495 cubic yards sand quarried, and 195 cubic yards of riprap dam built, '91, 2263.

1891-'92. 6,000 cubic yards stone used in construction of 3,492 linear feet of wing dams, '92, 1924.

**Projects.**

By Lieut. Adams, 1870, for securing a channel 2½ feet deep at ordinary low water from Leadvale to the mouth, a distance of 90 miles, by construction of wing dams and removal of snags and obstructions; estimated cost, \$150,000, '71, 493, 494; '80, 187, 1680; '86, 1520; '91, 2263.

**FRENCH BROAD RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 208.)

**Appropriations.**

1876-'82 ..... \$43,000

List of appropriations, '88, 844; '91, 2262.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 116; '91, 280.

ENGINEERS IN CHARGE.

S. T. Abert, U. S. agent, 1878-'91. Report, '88, 843.

Lient. Col. J. W. Harlow, 1891-'—. Report, '91, 2261.

**Operations.**

1887-'88. Operations suspended since 1883, '88, 844.

**Projects.**

By S. T. Abert, 1878 and 1883, for improvement of the river by dredging and removal of obstructions, giving channels 35 feet wide and  $2\frac{1}{2}$  feet deep at low water between Brevard and Big Buck shoals, and 30 feet wide and  $2\frac{1}{2}$  feet deep from Smiths Bridge to Long Shoal; estimated cost, \$122,000, '88, 844.

**FRONTBERG, N. Y., Harbor of Refuge at.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 337.

ENGINEER IN CHARGE.

Capt. C. F. Palfrey, 1888. Report, '89, 2428.

**Physical Characteristics.**

Description of the locality, '89, 2426.

**Plans.**

By Capt. Palfrey, 1889, for formation of a harbor of refuge at Frontberg, by construction of an east and a west pier, dredging the channel entrance to 18 feet, and the harbor basin to 16 feet mean low water; estimated cost, \$450,000, '89, 2427.

**Surveys.**

Examination for harbor of refuge ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Palfrey, '89, 2427.

**GALVESTON BAY, WEST, TEX.—SURVEY OF.****Appropriations.**

1892 ..... \$15,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '92, 228.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1890. Report, '92, 1563, 1568.

ASSISTANTS.

R. B. Talfor. Report, '92, 1565.

G. Bagnall. Report, '92, 1569.

**Physical Characteristics.**

Description of the locality, '92, 1563.

**Plans.**

By Maj. Allen, 1891, for straightening and deepening the channels by dredging, so as to afford a least width of 200 feet and depth of  $3\frac{1}{2}$  feet in West Bay, between the railroad bridges near Galveston and San Luis Pass, and a least width of 100 feet and depth of 3 feet in Oyster Bay, along Christmas Point; also, marking the channel by beacons; estimated cost, \$28,998, '92, 1568, 1569.

**Surveys.**

Ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Allen, '92, 1566.



**GALVESTON BAY SHIP CHANNEL, TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 210.)

**Appropriations.**

1872-'82 .....	\$486,500
1888 .....	100,000, '88, 1281.
1890 .....	40,000, '91, 1909.
1892 .....	40,000, '92, 1539.

Total ..... 666,500

List of appropriations, '90, 1799.

**Contracts.**

1888. G. C. Fobes, for dredging, at 11.3 cents per cubic yard, '88, 1282. G. C. Fobes, for dredging, at 12½ cents per cubic yard, '89, 1551.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 173; '89, 203; '90, 183; '91, 232; '92, 225.

**BOARD OF ENGINEERS.**

Convened at Galveston, Tex., December 4, 1890, by S. O. No. 66, to report upon value of channel constructed by the Buffalo Bayou Ship Channel Company in Galveston Bay. Report, '91, 1910. (Col. Comstock, Maj. Allen, and Lieut. Langfitt.)

**ENGINEERS IN CHARGE.**

Maj. O. H. Ernst, 1886-'90. Reports, '88, 1279; '89, 1548.

Maj. C. J. Allen, 1890-'—. Reports, '90, 1797; '91, 1906; '92, 1536.

**ASSISTANTS.**

E. M. Hartrick. Reports, '88, 1282; '89, 1551; '90, 1800.

G. Bagnall. Reports, '91, 1909; '92, 1539.

**Operations.**

1887-'88. 200,000 cubic yards material dredged from ship channel, '88, 1284.

1888-'89. 1,618,220 cubic yards material dredged from ship channel, '89, 1549.

1889-'90. 19,829 cubic yards material dredged, '90, 1798.

1890-'91. No operations, '91, 1908.

1891-'92. Maintenance and repair of beacons and triangulation stations, '92, 1539.

**Projects.**

The project of 1871-'77 proposed the formation of a dredged channel 100 feet wide at bottom and 12 feet deep at mean low water from the head of Bolivar to the U. S. cut through Red Fish Bar, thence to the cut through Morgans Point; estimated cost, \$446,326.42, '78, 608; '79, 918; '83, 1078.

In 1883 the Board of Engineers considered that the channel could not be made permanent at any reasonable cost, '83, 1081. Recommended by Chief of Engineers that available funds be reserved pending the action of Congress, '83, 1082; '84, 217.

**Surveys.**

Resurvey of channel. Made, 1889, under direction of Maj. Ernst, '89, 1549.

**MAPS.**

'90, 1800; '91, 1911.

**GALVESTON HARBOR, TEX.—IMPROVEMENT OF ENTRANCE TO.**

(Continued from Vol. II, p. 211.)

**Appropriations.**

1870-'87 .....	\$1,778,000
1888 .....	500,000, '88, 1269.
1890 .....	500,000, '90, 1770.
1891 .....	600,000
1892 .....	450,000, '92, 1527.

Total ..... 3,828,000

List of appropriations, '90, 1769; '91, 1875.

**Contracts.**

1888. A. M. Shannon & Co., for riprap jetty construction, at a total of \$402,475, '89, 1538.

1890. O'Connor, Laing & Smoot, for construction of railway, including trestle, and for furnishing sandstone, riprap, and granite blocks in place, at \$3,469,710, '91, 1879.

**GALVESTON HARBOR, TEX.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 172; '89, 203; '90, 182; '91, 231; '92, 224.

**BOARD OF ENGINEERS.**

Convened at Philadelphia, December 11, 1889, by S. O. No. 29, to examine and report upon the most eligible location for a deep water harbor on the northwest coast of the Gulf of Mexico. Report, '90, 1781. (Lient. Cols. Robert, Gillespie, and Smith.)

**ENGINEERS IN CHARGE.**

Maj. O. H. Ernst, 1886-'90. Reports, '88, 1265; '89, 1535.

Maj. C. J. Allen, 1890-'—. Reports, '90, 1767; '91, 1871; '92, 1523.

**ASSISTANTS.**

Lieut. G. A. Zinn. Report, '88, 1270.

H. C. Ripley. Reports, '88, 1272; '89, 1542.

Lieut. W. C. Langfitt. Reports, '89, 1538; '90, 1770; '91, 1879; '92, 1527.

G. Bagnall. Reports, '90, 1779; '91, 1896.

E. M. Hartrick. Reports, '91, 1890; '92, 1529.

**Operations.**

1887-'88. 4,550 linear feet of the old south jetty built up to 5 feet above mean low water under contract; 90,125 cubic yards riprap stone blocks and clay used, '88, 1266, 1272.

1888-'89. 464 linear feet of shore branch of jetty built; jetty extended seaward 900 feet, and 200 feet additional partly finished; 2,175 linear feet of trestle and railway built, '89, 1536.

1889-'90. South jetty extended 2,800 feet, and partially completed for an additional 1,200 feet; rock work completed upon 8,559 linear feet of shore branch; railway trestle extended 428 feet beyond incomplete rock work, '90, 1768, 1774.

1890-'91. 10,969 cubic yards of riprap and 4,320 cubic yards block stone placed in south jetty, '91, 1891. Rock work extended 350 feet and trestle and track 240 feet, '91, 1872.

1891-'92. 100,400 tons of riprap and 50,617 tons of granite blocks used in extension of south jetty 7,523 feet, '92, 1530.

**Physical Characteristics.**

Tidal observations, '88, 1270, 1276; '89, 1536, 1538, 1542; '90, 1770, 1773.

Effect of storms upon height of tide, '88, 1274.

Description of the passes and harbors on northwest coast of the Gulf of Mexico, '90, 1783.

Discussion of the relative advantages for the location of a deep-water harbor or outer harbor off Padre Island, mouth of Brazos River, Cedar Bayou, Corpus Christi Pass, Brazos Santiago entrance, San Luis Pass, Pass Cavallo, Sabine Pass, Aransas Pass, and Galveston entrance, '90, 1783, 1788.

**Projects.**

From 1870 to 1872, inclusive, \$76,000 was appropriated, which was expended in building and operating a dredge on the inner bar and in strengthening the Fort Point Jetty, '71, 517; '72, 554; '74, i, 724.

The project of 1874, by Capt. Howell, proposed the removal of the inner bar between Fort Point and Pelican Spit, and deepening the channel over the outer bar to 18 feet. It was proposed to effect the first by continuing the city dike to the edge of Bolivar Channel and thereby secure sufficient contraction to scour the desired channel; the second was to be accomplished by prolonging the first dike seaward and by the construction of a parallel dike from Bolivar Point. In place of stone it was proposed to use gabions covered with hydraulic cement and filled with sand, '74, i, 732, 736; '80, 1221.

From 1874 to 1879, inclusive, \$577,000 was appropriated under this project, resulting in a 20-foot channel over the inner bar, '80, 147.

In 1879 a Board of Engineers recommended that no more gabions be made, and that those on hand be strengthened and used for further experiment; also that trial be made of the Dutch system of jetties composed of alternate layers of mattress and stone, '80, 1270.

In 1880 the Board of Engineers further recommended the use of broad foundation mattress covered with brush and stone or concrete blocks, '80, 1227, 1230. Sketches of jetties as proposed, '80, 1228. Estimated cost, including appropriation of 1880, \$1,825,813. '81, 1328. Least depth proposed over outer bar, '84, 217; '85, 1450; '86, 1297.

The Board of 1886 recommended to build up and complete the present south jetty to the crest of the outer bar; to build a north jetty to crest of bar; to extend both jetties to the 30-foot curve in the Gulf; to do such dredging from time to time, in aid of tidal scour, as the rate of appropriation given may afford, '86, 1292.

**GALVESTON HARBOR, TEX.—Continued.****Projects—Continued.**

Interval between outer ends of jetties to be 7,000 feet, '86, 1308. Depth to be obtained, '86, 223, 1309, 1311. General plan of construction, '86, 1310. Estimated cost, \$7,000,000, in addition to \$1,478,000 appropriated prior to 1886, or an aggregate of \$8,478,000, '86, 1311; '87, 1416.

**Surveys.**

Resurvey of harbor entrance. Made, 1888, under direction of Maj. Ernst, '88, 1267, 1277.

Resurvey of harbor entrance. Made, 1889, under direction of Maj. Ernst, '89, 1536, 1546.

Resurvey of harbor entrance. Made, 1890, under direction of Maj. Allen, '90, 1768, 1777.

**MAPS.**

'88, 1278; '89, 1536; '90, 1772, 1776; '91, 1875, 1889; '92, Atlas, 79, 80, 81.

**GASCONADE RIVER, MO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 213).

**Appropriations.**

1880-'87 .....	\$37,500
1888 .....	5,000, '88, 1448.
1890 .....	4,000, '90, 1990.
1892 .....	4,000, '92, 1740.

Total ..... 50,500

List of appropriations, '88, 1448; '91, 2112.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 194; '89, 229; '90, 205; '91, 261; '92, 251.

**ENGINEER IN CHARGE.**

Maj. A. M. Miller, 1885-'— Reports, '88, 1448; '89, 1703; '90, 1989; '91, 2112; '92, 1739.

**ASSISTANT.**

J. W. Beaman. Reports, '88, 1449; '89, 1704; '90, 1990; '91, 2113; '92, 1740.

**Operations.**

1887-'88. 943 linear feet of dam, or training wall, built by hired labor, '88, 1448.

1888-'89. 284 snags and stumps removed from the channel and 446 trees cut from the banks, improving 78 miles of river; work done by hired labor, '89, 1903.

1889-'90. 65 linear feet of bank revetment laid; 22 log cribs built; 522 linear feet of crib and stone dam built, and 150 snags removed from the channel; work done by hired labor, '90, 1989.

1890-'91. 276 cubic yards stone quarried; repairs to plant, '91, 2112.

1891-'92. 419 snags removed from the channel; 2,153 trees cleared from the banks, '92, 1741.

**Projects.**

By Maj. Suter, 1880, for improvement of river from its mouth to Vienna, a distance of 78 miles, by removal of snags and similar obstructions; estimated cost, \$50,000, '80, 1466; '91, 2112.

**GAULEY RIVER, W. VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 214.)

**Appropriations.**

1888 .....	\$3,000, '88, 224.
1890 .....	3,000, '90, 2248.
1892 .....	3,000, '92, 2068.

Total ..... 9,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 224, 226; '89, 260; '90, 234; '91, 301; '92, 288.

**GAULEY RIVER, W. VA.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Col. W. P. Craighill, 1886-'89. Report, '88, 1761.

Capt. T. Turtle, 1889-'90. Report, '89, 1959.

Col. W. P. Craighill, 1890-'—. Reports, '90, 2248; '91, 2428; '92, 2067.

**ASSISTANTS.**

N. H. Hutton. Report, '88, 1762.

W. P. Smith. Reports, '89, 1959; '90, 2249; '91, 2429; '92, 2068.

**Operations.**

1887-'88. No operations, '88, 224.

1888-'89. 52 cubic yards rock blasted and removed, '89, 1960.

1889-'90. No operations, '90, 2248.

1890-'91. 212 cubic yards solid and 2,070 cubic yards loose rock removed from the channel, '91, 2430.

1891-'92. 3,184 cubic yards rock removed, and 6,980 linear feet of training wall built, '92, 2067.

**Physical Characteristics.**

Description of the locality, '88, 1761.

**Projects.**

By Capt. Turtle, 1887, for improvement of the river for a distance of 12 miles, from its mouth to a point called "The Roughs," by removal of rock ledges and obstructions, giving a channel 20 feet wide and 2 feet deep at ordinary low water; estimated cost, \$10,000, '88, 224. Also for improvement at and above "The Roughs" by rock removal and construction of training walls; estimated cost, \$65,000. Total estimated cost of project, \$75,000, '88, 224; '89, 1959; '92, 2067.

**Surveys.**

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Col. Craighill, '88, 1761.

**MAPS.**

'88, 1762.

**GEDNEYS CHANNEL, New York Harbor.—(See NEW YORK HARBOR.)****GENESEE RIVER, N. Y.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 337.

**ENGINEER IN CHARGE.**

Capt. C. F. Palfrey, 1888. Report, '89, 2424.

**Plans.**

In 1889 Capt. Palfrey did not consider the locality worthy of improvement, '89, 2425.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Palfrey, '89, 2424.

**GEORGETOWN HARBOR, D. C.—(See POTOMAC RIVER IN VICINITY OF WASHINGTON.)****GEORGETOWN HARBOR, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 214.)

**Appropriations.**

1836-'87 .....	\$21,000
1888 .....	7,500, '88, 927.
1890 .....	8,000, '90, 1166.
1892 .....	12,000, '92, 1184.

Total .....	48,500
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**GEORGETOWN HARBOR, S. C.—Continued.****Commerce.**

Gain from 1880 to 1889, '89, 1106; '90, 1168.

**Contracts.**

1889. P. S. Ross, for dredging, at 23 cents per cubic yard, '89, 1104.

1890. P. S. Ross, for dredging, at 29 cents per cubic yard, '91, 1409.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 129; '89, 146; '90, 132; '91, 168; '92, 168.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 925; '89, 1102; '90, 1165; '91, 1408.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1183.

**ASSISTANT.**

R. Whitford. Reports, '88, 927; '89, 1104; '90, 1167; '91, 1410; '92, 1184.

**Operations.**

1887-'88. No operations for lack of funds, '88, 926.

1888-'89. 15,563 cubic yards material dredged from channel under contract; 130 stumps and logs removed, '89, 1103.

1889-'90. No operations for lack of funds, '90, 1166.

1890-'91. No operations, '91, 1408.

1891-'92. 13,448 cubic yards material dredged and 142 cypress stumps removed from the channel, '92, 1184.

**Physical Characteristics.**

Original condition of harbor, '88, 925.

**Projects.**

By Capt. Phillips, 1881, for dredging a channel 200 feet wide, with a depth of 12 feet through the shoal across the mouth of Sampit River, one-half mile from Georgetown; the total final cost of this work was estimated, in 1888, at \$42,000; raised in 1889 to \$44,500, '89, 1103. Amount appropriated to June 30, 1889, \$24,500; amount required for completion, \$20,000, '89, 1103.

**Surveys.****MAPS.**

'89, 1104; '92, Atlas, 41, 42.

**GLEN COVE HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 215.)

**Appropriations.**

1888..... \$20,000, '88, 56.

1890..... 15,000, '90, 633.

1892..... 10,000, '92, 721.

Total ..... 45,000

**Contracts.**

1889. Brown & Fleming, for gneiss riprap, at 83 cents per ton, '89, 729.

1890. J. A. Bouker, for breakwater extension, at 80 cents per cubic yard for stone, '91, 822.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 56; '89, 69; '90, 61; '91, 77; '92, 82.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886-'—. Reports, '89, 728; '90, 662; '91, 820; '92, 720.

**Operations.**

1887-'88. No operations, '88, 56.

1888-'89. 4,216 tons stone placed in 220 linear feet of breakwater, '89, 728.

1889-'90. 8,284 tons stone placed in 350 linear feet of breakwater, '90, 663.

1890-'91. 3,024 cubic yards stone delivered in the breakwater, '91, 821.

1891-'92. 13,220 cubic yards riprap gneiss placed in breakwater extension, '92, 721.

**Physical Characteristics.**

Description of the locality, '89, 728.

**Projects.**

By Col. Houston, 1886, for construction of 2,500 linear feet of riprap breakwater extending from Mosquito Point in a westerly direction; estimated cost, \$201,960, '87, 646; '89, 728; '92, 720.

**Surveys.****MAPS.**

'89, 728.

**GLOUCESTER HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 215.)

**Appropriations.**

1823-'87 .....	\$21,000
1888.....	10,000, '88, 444.
1890.....	15,000, '90, 492.
1892.....	40,000, '92, 568.

Total .....	86,000
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**Commerce.**

Vested interests of the harbor, '88, 444.

Importance of the harbor, '90, 491.

**Contracts.**

1888. Duncan &amp; Mickerson, for rock removal, at \$14.75 per cubic yard, '88, 444.

1889. G. W. Townsend, for blasting and removing rock, at \$20 per cubic yard, and for removal of loose overlying material, at \$15 per cubic yard, '89, 566. Bay State Dredging Company, for dredging, at 30 cents per cubic yard, '89, 566.

1890. Bay State Dredging Company, for dredging, at 22 cents per cubic yard, and for removal of boulders weighing over 3 tons, at \$8 each, '91, 637.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 25; '89, 35; '90, 30; '91, 36; '92, 43.

ENGINEERS IN CHARGE.

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 442.

Lieut. Col. S. M. Mansfield, 1889-'—. Reports, '89, 564; '90, 491; '91, 635; '92, 566.

**Operations.**

1887-'88. No operations, '88, 444.

1888-'89. 70 cubic yards loose rock and 100 cubic yards ledge removed; 17,596 cubic yards material dredged, '89, 565.

1889-'90. No operations for lack of funds, '90, 492.

1890-'91. No operations, '91, 636.

1891-'92. 47,298 cubic yards material dredged, '92, 568.

**Projects.**

The project of 1871 proposed to clear the harbor of sunken rocks and to build a stone breakwater from Eastern Point to Round Rock Shoal, '70, 870, 875; '71, 873; '87, 500.

The appropriation of \$10,000 of 1872 was expended upon the removal of rock, '73, 1083; '87, 501.

By Lieut. Col. Gillespie, 1887, for removal from the inner harbor of 101 cubic yards of rock and of 216,000 cubic yards material; also for the construction of the breakwater recommended in the project of 1884, extending from Eastern Point to Round Rock Shoal; estimated cost, \$817,000, '88, 443.

**GOOSE RAPIDS ON RED RIVER OF THE NORTH.—CONSTRUCTION OF LOCK AND DAM AT.**

(See RED RIVER OF THE NORTH, MINN. AND DAK.)

**GORDONS LANDING, LAKE CHAMPLAIN, VT.—CONSTRUCTION OF BREAKWATER AT.**

(Continued from Vol. II, p. 216.)

**Appropriations.**

1886.....	\$18,750
1888.....	10,000, '88, 2096.
1890.....	6,000, '90, 2878.

Total .....	34,750
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**Contracts.**

1888. W. J. Daly, for breakwater construction, '88, 2096.

**GORDONS LANDING, LAKE CHAMPLAIN, VT.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 287; '89, 340; '90, 307; '91, 385; '92, 363.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1886-'— Reports, '88, 2095; '89, 2445; '90, 2877; '91, 2930; '92, 2606.

**Operations.**

1887-'88. 4,711 cubic yards rubble stone placed in the breakwater, '88, 2096.

1888-'89. 3,570 cubic yards rubble stone placed in the breakwater, '89, 2446.

1889-'90. Breakwater construction continued, '90, 2877.

1890-'91. 3 cribs built and sunk in extension of breakwater, and reconstruction of old superstructure begun, '91, 2931.

1891-'92. No operations; improvement completed, '92, 2607.

**Projects.**

By Maj. Adams, 1887, for construction of a rubble-stone breakwater extending from a point 250 feet south of landing to a point on the 18-foot curve 100 feet north of a line drawn from the dock to Cumberland Head; estimated cost, \$38,158, '87, 2400; '92, 2607.

**GOSHEN CREEK, N. J.—SURVEY OF.****Appropriations.**

1890..... \$3,000

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 119.

**Physical Characteristics.**

Description of the locality, '91, 1116.

**Plans.**

By Maj. Raymond, 1891, for excavation of a channel below Goshen Landing to a low-water depth of 3 feet and width of 30 feet, dredging a channel 3 feet deep and 50 feet wide through the bar at the mouth of the creek and out to the limit of the sand formation beyond the low-water shore line, and the protection of the dredged channel by a sheet-pile jetty on the south side of the channel extending about 600 feet outside of the low-water line of the bay; estimated cost, \$12,000, '91, 1119.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Raymond, '91, 1118.

**GOWANUS BAY, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 216.)

**Appropriations.**

1881-'87 ..... \$72,500  
1888..... 60,000, '88, 617.  
1890..... 160,000, '90, 731.  
1892..... 198,600, '92, 823.

Total ..... 491,100

List of appropriations, '88, 616.

**Contracts.**

1889. J. A. Simmons, for dredging, at 18½ cents per cubic yard, '89, 787.

1891. W. H. Beard, for dredging, at 21 cents per cubic yard, '91, 917. W. H. Beard, for dredging, at 21 cents per cubic yard, '91, 918.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 62; '89, 78; '90, 70; '91, 89; '92, 93.

**ENGINEERS IN CHARGE.**

Lient. Col. W. McFarland, 1886-'89. Report, '88, 613.

Lient. Col. G. L. Gillespie, 1889-'— Reports, '89, 784; '90, 727; '91, 914; '92, 817.

**GOWANUS BAY, N. Y.—Continued.****Operations.**

- 1887-'88. No operations, '88, 615.  
 1888-'89. 38,938 cubic yards material dredged; two canal-boat wrecks removed, '89, 787.  
 1889-'90. 135,967 cubic yards material dredged, '90, 730.  
 1890-'91. 268,000 cubic yards material dredged, '91, 917.  
 1891-'92. 520,000 cubic yards material dredged from Red Hook, Gowanus Creek, and Bay Ridge channels, '92, 820.

**Physical Characteristics.**

Description of the bay, '88, 613.

**Projects.**

- By Col. Newton, 1881, for dredging channel 200 feet wide and 18 feet deep at mean low water from the 18-foot contour outside the bay to Hamilton Avenue Draw-bridge, the last 400 feet narrowing down to a width of 100 feet; estimated cost, \$182,850, '81, 636.  
 Revised project for dredging the natural channel from Hamilton Avenue Draw-bridge to southwest corner of Erie Basin, and thence two channels, one running northerly along the west side of Erie Basin to deep water near Red Hook, the other running southerly along the wharves on the south side of the bay; estimated cost, \$192,564, '81, 672, 673; '87, 712.  
 In 1887 Lieut. Col. McFarland considered that the Red Hook, Bay Ridge, and Gowanus Creek channels should be widened to 400 feet with a low-water depth of 21 feet; estimated cost, \$403,500, '87, 712.  
 By Lieut. Col. Gillespie, 1889, for increasing the depth of the Gowanus Bay channels to 21 feet at mean low water and increasing their width to 400 feet; also removal of angle on south side of Gowanus Creek near its mouth; estimated cost, \$600,000, '89, 785, 786; '91, 916.

**GRAND HAVEN HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 218.)

**Appropriations.**

1852-'87 .....	\$523,866.15
1888.....	25,000.00, '88, 1912.
1890.....	75,000.00, '90, 2647.
1892.....	90,000.00, '92, 2340.

Total ..... 713,866.15

List of appropriations, '92, 2343.

**Contracts.**

1889. Hagen and English, for stone, at \$7.90 per cord, '89, 2186.  
 T. W. Kirby, for edgings, at \$1.20 per cord. Cutter & Savage Lumber Company, for timber, at \$16.75 per 1,000 feet, B. M., and plank, at \$13.50 per 1,000 feet, B. M., '89, 2186. Parkhurst & Wilkinson, for drift bolts, at 2.05 cents per pound, '89, 2186. C. Berner, for pier construction, at a total of \$14,956, '89, 2186.  
 1890. E. G. Crosby, for timber crib construction, at a total of \$23,418, '91, 2695.  
 E. G. Crosby, for pine piles, at 10 cents per linear foot, and white pine timber, at \$17 per M feet; Gaylord & Wing, for white pine plank, at \$15 per M feet; Parkhurst & Wilkinson, for tie rods, at 3 cents per pound; F. A. Hagen, for stone, at \$2.24 per cord, '91, 2695.  
 1892. Truman & Cooper, for extension and repair of south pier, at \$2,047, '92, 2345.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 255; '89, 300; '90, 270; '91, 340; '92, 326.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1911.

Maj. W. Ludlow, 1889-'— . Reports, '89, 2184; '90, 2646, 2648; '91, 2692; '92, 2340, 2346.

**Operations.**

- 1887-'88. South pier extended 52 feet and north pier 150 feet under contract; repairs to south pier by hired labor, '88, 1912.  
 1888-'89. Extensive repairs to south pier revetment; 100 linear feet crib work built, '89, 2184.  
 1889-'90. North pier extended 150 feet; 2,388 linear feet of south pier revetment repaired; 600 linear feet sand fence built, '90, 2647.  
 1890-'91. 6,000 cubic yards material dredged; construction of crib work for pier extension begun; repairs to plant, '91, 2694.



**GRAND HAVEN HARBOR, MICH.—Continued.****Operations—Continued.**

1891-'92. Construction of crib in extension of south pier; sunken end of south pier rebuilt, and repairs made to timber and filling of north and south piers, '92, 2342.

**Physical Characteristics.**

Description of the locality, '89, 2184, 2185.

**Plans.**

By Maj. Ludlow, 1890, for extension of north bank revetment; repairing piers and extending same 200 and 300 feet, respectively; estimated cost, \$74,200, '90, 2651.

**Projects.**

By Maj. Wheeler, 1866, revised in 1867, for construction of two parallel crib-work piers, 2,208 and 608 feet long, respectively, to afford a channel of entrance of navigable width and not less than 18 feet deep; estimated cost, \$352,770.47, '76, ii, 494; '80, 217, 2033.

After an aggregate appropriation since 1866 of \$301,866.15, Maj. Harwood proposed, in 1880, the extension of piers to 18-foot water, beach protection, and repairs to existing works; estimated cost, \$365,600, '80, 2024.

**Surveys.**

MAPS.

'90, 2650.

**GRAND CALUMET RIVER, ILL.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 293.

ENGINEER IN CHARGE.

Capt. W. L. Marshall, 1888. Report, '89, 2158.

**Plans.**

By Capt. Marshall, 1889, for a 16-foot channel 200 feet wide from the mouth to above the Forks; estimated cost, \$1,000,000, '89, 2158, 2159.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Marshall, '89, 2158.

**GRAND CALUMET RIVER, IND.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 293.

ENGINEER IN CHARGE.

Capt. W. L. Marshall, 1888. Report, '89, 2151.

ASSISTANT.

G. A. M. Liljencrantz. Report, '89, 2153.

**Physical Characteristics.**

Description of the locality, '89, 2153.

**Plans.**

In 1888 Capt. Marshall did not consider the locality worthy of improvement, '89, 2152.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Marshall, '89, 2151.

**GRAND MARAIS HARBOR, MINN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 219.)

**Appropriations.**

1879-'87 .....	\$80,000
1888.....	15,000, '88, 1815.
1890.....	22,350, '91, 2284.
1892.....	10,000, '92, 2122.

Total .....

List of appropriations, '88, 1815; '91, 2484.

**GRAND MARAIS HARBOR, MINN.—Continued.****Commerce.**

Importance of the locality as a harbor of refuge, '88, 1814; '90, 2282.

**Contracts.**

1888. Williams, Upham & Co., for dredging, at 24 cents per cubic yard, '89, 1997.  
1890. Williams, Daugherty & Upham, for dredging, at 20 cents per cubic yard, '91, 2485.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 232; '89, 267; '90, 241; '91, 310; '92, 296.

**ENGINEERS IN CHARGE.**

Maj. J. B. Quinn, 1886-'91. Reports, '88, 1814; '89, 1996; '90, 2282.

Capt. W. L. Fisk, 1891-'—. Reports, '91, 2484; '92, 2121.

**Operations.**

1887-'88. Dredging in anchorage area continued, '88, 1814.

1888-'89. 14,572 cubic yards material dredged, '89, 1996.

1889-'90. 47,927 cubic yards material dredged, '90, 2282.

1890-'91. Repairs to breakwater, '91, 2484.

1891-'92. 70,851 cubic yards material dredged; repairs to breakwater, '92, 2122.

**Projects.**

From 1887 to 1888 operations were conducted under Maj. Quinn's project of 1887, for an extension of the dredged area and the breakwater, at an estimated cost of \$254,444, '87, 1954; '88, 1814.

In 1889 Maj. Farquhar's project of 1875 was substituted. This provided for dredging within the area bounded by Mayhews Point and the inner shore line, and construction of timber and stone breakwater to narrow the entrance and afford shelter for vessels; estimated cost, \$139,669, '75, i, 184; '79, 150; '80, 1882, 1883; '86, 290; '89, 1996; '92, 2122.

**Surveys.****MAPS.**

'90, 2282; '92, Atlas, 101.

**GRAND MARAIS, MICH., Harbor of Refuge at.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 220.)

**Appropriations.**

1880-'87 .....	\$131,250
1888 .....	50,000, '88, 1834.
1890 .....	50,000, '90, 2305.
1892 .....	30,000, '92, 2147.

Total ..... 261,250

List of appropriations, '90, 2304; '91, 2510.

**Contracts.**

1888. M. H. Fitzpatrick, for dredging, at 19½ cents per cubic yard, '89, 2025.

1889. Powell & Mitchell, for superstructure construction, at a total of \$24,928, '89, 2025.

1890. H. Steele, for repairs to pier work, at a total of \$1,500; C. S. Barker, for dredging, at 17 cents per cubic yard, '91, 2511.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 235; '89, 273; '90, 246; '91, 316; '92, 301.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'89. Report, '88, 1832.

Maj. J. B. Quinn, 1889-'91. Reports, '89, 2023; '90, 2303.

Capt. W. L. Fisk, 1891-'—. Reports, '91, 2509; '92, 2145.

**Operations.**

1887-'88. West crib pier extended 200 feet by sinking 4 cribs, '88, 1833.

1888-'89. No operations, '89, 2024.

1889-'90. 75,392 cubic yards material dredged, '90, 2303.

1890-'91. Repairs to pier work, and dredging, '91, 2509.

1891-'92. Channel 175 feet wide with a least depth of 17 feet dredged between the piers, '92, 2146.

**GRAND MARAIS, MICH., Harbor of Refuge at—Continued.****Projects.**

By Board of Engineers, 1881, for the formation of a harbor of refuge at Grand Marais, Mich., by access to the bay through two parallel piers, 1,550 and 1,900 feet in length, respectively, with a dredged channel between them of 500 feet width and 20 feet depth at its lake end, and 300 feet width and 18 feet depth at its harbor end; estimated cost, \$450,000, '81, 2053; '87, 1999; '91, 2510.

**Surveys.****MAPS.**

'88, 1834; '89, 2024; '90, 2304.

**GRAND RIVER, OHIO.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 373; '92, 352.

**ENGINEER IN CHARGE.**

Maj. L. C. Overman, 1890. Report, '92, 2511, 2513.

**Physical Characteristics.**

Description of the locality, '92, 2511.

**Plans.**

By Maj. Overman, 1891, for excavation of a channel 160 feet wide, 18 feet deep, and 7,310 feet long, at an estimated cost of \$39,000, '92, 2514.

**Surveys.**

Survey made, 1891, under direction of Maj. Overman, '92, 2513.

**GRAND RIVER, MICH.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 306; '91, 345.

**BOARD OF ENGINEERS.**

Convened at New York City to examine and report upon project for improvement of Grand River. Report, '90, 2618. (Cols. Abbot, Comstock, and Houston, and Lieut. Col. Gillespie.)

**ENGINEERS IN CHARGE.**

Lieut. Col. S. M. Mansfield, 1888. Report, '89, 2206.

Maj. W. Ludlow, 1890. Report, '90, 2676.

**Plans.**

In 1888 Lieut. Col. Mansfield did not consider the locality worthy of improvement, '89, 2207.

**Surveys.**

Examinations from Grand Rapids to Lake Michigan ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Mansfield, '89, 2206.

**GRAND RIVER, MO.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 230.

**ENGINEER IN CHARGE.**

Maj. A. M. Miller, 1888. Report, '89, 1709.

**Plans.**

In 1888 Maj. Miller did not consider that the general needs of the local commerce called for any improvement, '89, 1711.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Miller, '89, 1709.

**GRASS RIVER AT MASSENA, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 223.)

**Appropriations.**

1882..... \$3,000  
 1890..... 6,000, '90, 2875.

Total ..... 9,000

**Contracts.**

1888. W. J. Daly, for dredging, at \$8 per hour, '89, 2442.  
 1890. Daly Bros., for dredging, '91, 2927.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 286; '89, 338; '90, 306; '91, 384.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1885. Reports, '88, 2092; '89, 2442; '90, 2874; '91, 2928.

**Operations.**

1887-'88. No operations, '88, 2092.  
 1888-'89. 1,670 cubic yards material dredged, '89, 2442.  
 1889-'90. No operations, '90, 2874.  
 1890-'91. 5,165 cubic yards material dredged, '91, 2927.

**Projects.**

By Maj. McFarland, 1881, for improvement of Grass River from mouth to Haskells Wharf by dredging a channel 4 feet deep at low water; estimated cost, \$12,000, '81, 2458. Increased, 1885, \$7,000, '85, 2297. Increased, 1886, \$1,600, '86, 1889; '87, 2398.

**GRAYS HARBOR AND BAR, WASH.—SURVEY OF.**

(See also CHEHALIS RIVER.)

**Appropriations.**

1892..... \$50,000

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 411.

**ENGINEER IN CHARGE.**

Capt. T. W. Symons, 1890. Report, '91, 3297.

**ASSISTANTS.**

R. A. Habersham. Report, '91, 3298.

A. J. McMillan. Report, '91, 3302.

**Physical Characteristics.**

Description of the locality, '91, 3298.

**Plans.**

In 1891 Capt. Symons reported that no improvement of the bar was needed at present, and proposed the improvement of the harbor, and of Chehalis River emptying into the same, by removal of two shoals in the harbor, and by dike construction, excavation of a channel 200 feet wide and 16 feet deep at half tide through the shoals, and closing sloughs in Chehalis River; estimated cost, \$150,000, '91, 3302.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Symons, '91, 3300.

**MAPS.**

'91, 3302.

**GRAYS RIVER, WASH.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 421.

**ENGINEER IN CHARGE.**

Maj. T. H. Handbury, 1890. Report, '91, 33853.

**Physical Characteristics.**

Description of the locality, '91, 3386.

**GRAYS RIVER, WASH.—Continued.****Plans.**

By Maj. Handbury, 1891, for removal of obstructions, snags, logs, etc., at a cost of \$2,500, '91, 3387.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Handbury, '91, 3386.

**GREAT CACAPON RIVER, W. VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 124.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1888. Report, '89, 995.

**Physical Characteristics.**

Description of the locality, '89, 995.

**Plans.**

In 1888 Lieut. Col. Hains did not consider the locality worthy of improvement, '89, 995.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Hains, '89, 995.

**GREAT CHAZY RIVER, N. Y.—IMPROVEMENT OF.****Appropriations.**

1890..... \$10,000, '91, 2929.

1892..... 5,000, '92, 2606.

Total ..... 15,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 344; '91, 385; '92, 363.

ENGINEER IN CHARGE.

Maj. M. B. Adams, 1888.—. Reports, '89, 2464; '91, 2929; '92, 2605.

ASSISTANT.

F. M. Barstow. Report, '89, 2464.

**Operations.**

1890-'91. Channel excavation under contract begun, '91, 2929.

1891-'92. 26,338 cubic yards material dredged, '92, 2606.

**Physical Characteristics.**

Description of the locality, '89, 2466.

**Plans.**

By Maj. Adams, 1889, for the formation of a dredged channel 6 feet deep and 75 feet wide from the 6-foot curve in Lake Champlain to Champlain Village; estimated cost, \$34,000, '89, 2466.

**Projects.**

By Maj. Adams, 1891, for the formation of a dredged channel with a least depth of 5 feet and a least width of 40 feet from the 5-foot curve in Lake Champlain to Champlain Village; estimated cost, \$18,000, '91, 2929; '92, 2605.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Adams. '89, 2466.

**GREAT KANAWHA RIVER, W. VA.—(See KANAWHA RIVER, GREAT.)****GREAT PEE DEE RIVER, S. C.—(See PEE DEE RIVER, GREAT.)**

**GREAT SODUS HARBOR, N. Y.**—(See SODUS HARBOR, GREAT.)**GREAT WICOMICO RIVER, VA.**—(See WICOMICO RIVER, GREAT.)**GREEN BAY HARBOR, WIS.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 224.)

**Appropriations.**

1866-'87 .....	\$277,550
1888 .....	10,000, '88, 1843.
1890 .....	10,000, '90, 2335.
1892 .....	25,000, '92, 2181.

Total ..... 322,550

List of appropriations, '92, 2181.

**Contracts.**

1890. Green Bay Dredge and Pile Driver Company, for dredging, at 24½ cents per cubic yard, '90, 2334. White & Finch, for dredging, at 18 cents per cubic yard, '91, 2535.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 238; '89, 277; '90, 250; '91, 320; '92, 306.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1842; '89, 2049; '90, 2334; '91, 2533.

Maj. J. F. Gregory, 1892-'— Report, '92, 2180.

**Operations.**

1887-'88. 620 linear feet of superstructure rebuilt, '88, 1843.

1888-'89. No operations, '89, 2050.

1889-'90. 6,825 cubic yards material dredged by hired labor, '90, 2334.

1890-'91. 29,737 cubic yards material dredged, '91, 2534.

1891-'92. 15,531 cubic yards material dredged, '92, 2180.

**Projects.**

By Maj. Houston, 1872, for dredging the cut so as to widen and deepen it to 14 feet throughout, requiring the removal of about 175,000 cubic yards of material; estimated cost, \$50,000, '72, 31, 116; '73, 198. Subsequently increased to \$75,000, '74, 1, 38, 140.

After an aggregate of appropriations amounting to \$235,550, Maj. Robert, in 1881, proposed dredging a channel 200 feet wide and 14 feet deep, revised datum, from mouth of Fox River to deep water in Green Bay, requiring the removal of 240,000 cubic yards; estimated cost, \$72,000, '81, 2070.

In 1892 the existing project was modified to increase the present channel depth to 16 feet and to extend it to a total length of 16,500 feet; estimated cost, \$91,915, '92, 2181.

**Surveys.**

Survey made, 1890, under direction of Maj. Davis, '90, 2334.

**GREEN JACKET SHOAL, R. I.**—(See PROVIDENCE RIVER.)**GREENPORT HARBOR, N. Y.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 225.)

**Appropriations.**

1882-'87 .....	\$25,000
1888 .....	5,000, '88, 578.
1890 .....	5,000, '90, 661.
1892 .....	11,000, '92, 713.

Total ..... 46,000

List of appropriations, '88, 577.

**GREENPORT HARBOR, N. Y.—Continued.****Contracts.**

1889. Wm. Molthrop & Co., for riprap granite, at \$1.23 per ton, '89, 727.  
 1891. Brown & Fleming, for stone, at \$1.29 per ton, '91, 813. Hartford Dredging Company, for dredging, at 18 cents per cubic yard, '91, 813.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 55; '89, 68; '90, 61; '91, 75; '92, 80.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886—'. Reports, '88, 577; '89, 725; '90, 660; '91, 811; '92, 711.

**Operations.**

- 1887-'88. 13,000 tons of riprap granite used in breakwater construction, '88, 577.  
 1888-'89. 2,410 tons riprap granite delivered in the breakwater, '89, 726.  
 1889-'90. 1,011 tons riprap granite delivered in the breakwater, '90, 661.  
 1890-'91. 520 tons of stone placed in breakwater, '91, 812.  
 1891-'92. 12,037 cubic yards material dredged; 594 tons stone delivered and placed in the breakwater, '92, 712.

**Physical Characteristics.**

Description of the harbor, '88, 577.

**Projects.**

By Maj. Barlow, in 1882, for construction of a rubble-stone breakwater upon Joshua Point Shoal, off Joshua Point, to cover Green Point Harbor anchorage from east and northeast storms, and to prevent further shoaling of the harbor by transfer of material from point and shoal above mentioned; estimated cost of breakwater, extending to 18-foot curve, \$46,000, '82, 635; '87, 630; '92, 712.

**GREEN RIVER AND TRIBUTARIES, KY.—OPERATION AND REPAIR OF LOCKS AND DAMS ON.**

(Continued from Vol. II, p. 226.)

**Appropriations.**

1888..... \$135,000, '89, 1965.  
 1892..... 50,000, '92, 2075.

Total ..... 185,000

**Contracts.**

1889. J. T. Williams & Bro., for construction of four lock houses, at a total of \$12,000, '89, 1968. Eigenham & Hollenbach, for furnishing dimension stone, at \$8,137, '89, 1968. M. A. Sweeney & Bro., for snag-boat construction, at \$18,400, '89, 1968.  
 1890. S. W. Cojlin, for construction of two dump scows, at \$1,293 per scow, '90, 2258.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 263; '90, 237; '91, 304; '92, 290.

**ENGINEER IN CHARGE.**

Maj. D. W. Lockwood, 1888—'. Reports, '89, 1965; '90, 2255; '91, 2439; '92, 2074.

**ASSISTANT.**

Lieut. W. L. Sibert. Reports, '89, 1969; '90, 2258; '91, 2443; '92, 2078.

**Operations.**

- 1888-'89. Repairs to buildings at Locks 1 and 2 on Green River; 12,000 cubic yards material dredged from lock approaches; plant built at Lock 3, Green River; work of removing fallen lock walls begun; construction of plant, '89, 1969.  
 1889-'90. 8 lock houses built; dredging at lock approaches; construction of new walls at Lock No. 3 begun; removal of old walls at Lock No. 1, Barren River, '90, 2256.  
 1890-'91. Repairs to lock, dam, guide cribs, and abutment at Lock and Dam No. 4, and Dam No. 1; 10,000 cubic yards material dredged from upper and lower lock entrances at Lock No. 2; repairs to Lock and Dam No. 3; 1,035 snags cleared from the river channel, '91, 2444, 2445.  
 1891-'92. Repairs to locks and dams 1, 2, 3, 4, and 7; 28,716 cubic yards material dredged at lock entrances; 1,080 snags, 6,000 linear feet of old crib timber, and old cofferdam removed; 472 trees cleared from the banks, '92, 2078, 2079.

**Projects.**

United States took possession of improvements on the Green and Barren rivers December 11, 1888, and the repair of locks and dams was begun. In 1888 \$46,557 was thus expended, and Maj. Lockwood estimated \$256,221 as required for works of repair during 1890, '89, 263, 1965.

**GREEN RIVER, KY.—EXAMINATION FOR EXTENSION OF SLACK-WATER NAVIGATION.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 310.

ENGINEER IN CHARGE.

Maj. D. W. Lockwood, 1891. Report, '91, 2473, 2481.

**Physical Characteristics.**

Description of the locality, '91, 2480.

**Plans.**

By Maj. Lockwood, 1891, for improvement of the river as far as Mammoth Cave, by the construction of two locks and dams, at an estimated cost of \$361,346, '91, 2482.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Lockwood, '91, 2481.

**GREENWICH BAY, R. I.—IMPROVEMENT OF.****Appropriations.**

1890..... \$2,000, '91, 717.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 56; '91, 56; '92, 60.

ENGINEERS IN CHARGE.

Maj. W. R. Livermore, 1888-'92. Reports, '89, 650; '91, 716.

Capt. W. H. Bixby, 1892-'— Report, '92, 623.

**Operations.**

1890-'91. 19,592 cubic yards material dredged, '91, 717.

1891-'92. No operations; project completed, '92, 624.

**Physical Characteristics.**

Description of the locality, '89, 650.

**Projects.**

By Maj. Livermore, 1888, for improvement of the entrance to the bay by widening the channel and giving a low-water depth of 10 feet by dredging; estimated cost, \$2,000, '89, 651; '91, 717; '92, 623.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Livermore, '89, 650.

**GUADALOUPE RIVER, TEX., removal of raft on.—EXAMINATION FOR.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 207.

ENGINEER IN CHARGE.

Maj. O. H. Ernst, 1888. Report, '89, 1577.

ASSISTANT.

R. B. Talfor. Report, '89, 1579.

**Physical Characteristics.**

Description of the locality, '89, 1579.

**Plans.**

In 1889 Maj. Ernst did not consider that the commerce to be effected justified an expenditure for removal of the rafts, '89, 1578.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Ernst, '89, 1577.



**GULF PORT HARBOR, MISS.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 193.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1888. Report, '89, 1460.

**Plans.**

In 1889 Maj. Damrell did not consider the improvement of the harbor desirable, '89, 1461.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Damrell, '89, 1460.

**GUNTERS CREEK, ALA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 288.

ENGINEER IN CHARGE.

Lient. Col. J. W. Barlow, 1890. Report, '91, 2325.

ASSISTANT.

J. W. Walker. Report, '91, 2326.

**Physical Characteristics.**

Description of the locality, '91, 2326.

**Plans.**

In 1890 Lient. Col. Barlow did not consider the locality worthy of improvement, '91, 2326.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lient. Col. Barlow, '91, 2326.

**GUTTENBURG, IOWA.—(See MISSISSIPPI RIVER FROM SAINT PAUL TO DES MOINES RAPIDS.)****GUYANDOTTE RIVER, W. VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 227.)

**Appropriations.**

1878-'87 .....	\$12,500
1888.....	2,000, '88, 1792.
1890.....	2,000, '90, 2277.
1892.....	2,000, '92, 2112.

Total ..... 18,500

List of appropriations, '92, 2112.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 228; '89, 265; '90, 239; '91, 308; '92, 294.

ENGINEER IN CHARGE.

Maj. D. W. Lockwood, 1888-'—. Reports, '88, 1791; '89, 1986; '90, 2276; '91, 2469; '92, 2111.

ASSISTANT.

B. F. Thomas. Reports, '90, 2277; '91, 2470; '92, 2112.

**Operations.**

1887-'89. No operations for lack of funds, '88, 1791; '89, 1986.

1889-'90. 1,197 cubic yards solid rock, 1,209 cubic yards loose rock, and 300 snags, stumps, and trees removed, '90, 2277.

1890-'91. Rock bar removed near Big Creek, 300 logs and a quantity of loose rock removed at mouth of Big Huff Creek, '91, 2470.

1891-'92. 424 cubic yards solid and 4,280 cubic yards loose rock, 347 snags and logs, and 7 drifts removed from the channel, '92, 2113.

**GUYANDOTTE RIVER, W. VA.—Continued.****Projects.**

- By Maj. Merrill, 1878, for removal of snags, rock, and other obstructions; estimated cost, \$10,000, '75, i, 794; '78, 108; '79, 1352; '80, 196.  
 By Capt. Post, 1884, for removal of snags, rock, and obstructions from mouth to Logan Court-House, 81 miles; also for purchase and removal of Roger's and Peck's mill dams; estimated cost, \$10,000, '84, 1753; '89, 1986; '92, 2111.

**HACKENSACK RIVER, N. J.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 93; '91, 108.

**ENGINEERS IN CHARGE.**

Capt. G. McC. Derby, 1888. Report, '89, 841.

Capt. T. L. Casey, 1888. Reports, '89, 842; '91, 1016, 1018.

**ASSISTANT.**

C. S. Kelsey. Reports, '89, 844; '91, 1019.

**Physical Characteristics.**

Description of the locality, '89, 842; '91, 1017.

**Plans.**

By Capt. Casey, 1889, for providing and maintaining a channel 10 feet deep at mean low water, and from 200 to 150 feet wide from the mouth to Turnpike Bridge at Hackensack; estimated cost, \$60,114; or, for a modified improvement, dredging a channel 8 feet deep at mean low water and from 200 feet wide from the mouth to Turnpike Bridge; estimated cost, \$22,308, '89, 845.

**Surveys.**

Survey ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Casey, '89, 842; '91, 1018.

**MAPS.**

'89, 844.

**HAMPTON CREEK AND BAR, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 228.)

**Appropriations.**

1878-'79 .....	\$12,000
1890.....	10,000, '91, 1297.

Total .....	22,000
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**Contracts.**

1891. Atlas Dredging Company, for dredging, at 11 cents per cubic yard, '91, 1298.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 120; '91, 148; '92, 150.

**ENGINEERS IN CHARGE.**

Capt. G. J. Fiebeger, 1888-'92. Reports, '89, 974; '91, 1297.

Lieut. E. Burr, 1892-'— Report, '92, 1089.

**ASSISTANT.**

T. T. George. Report, '89, 975.

**Operations.**

1891-'92. 84,321 cubic yards material dredged, '92, 1090.

**Physical Characteristics.**

Description of the locality, '89, 976.

**Projects.**

By Lieut. Fiebeger, 1888, for a channel 200 feet wide and 9 feet deep at mean low water from the mouth of the creek to Hampton Bridge; also a channel of the same depth through the bar, with a width of 200 feet at the mouth of the creek and 300 feet at the turning buoy; estimated cost, \$10,000, '89, 975.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Fiebeger, '89, 975.

**HAMPTON RIVER, N. H.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 31.

ENGINEER IN CHARGE.

Lieut. Col. J. A. Smith, 1888. Report, '89, 549.

**Physical Characteristics.**

Description of the locality, '89, 550.

**Plans.**

In 1888 Lieut. Col. Smith did not consider the locality as worthy of improvement, '89, 550.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Smith, '89, 549.

**HARBOR MOORINGS at Fort Ross, Fisks Mill, Fish Rock, Shelter Cove, Trinidad, etc., Cal.—EXAMINATION FOR.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 353.

ENGINEER IN CHARGE.

Maj. W. H. Heuer, 1888. Report, '89, 2498.

**Physical Characteristics.**

Description of the localities, '89, 2498.

**Plans.**

After examination of the localities, Maj. Heuer reported, in 1889, that he did not consider the desired improvement a necessity, '89, 2498.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Heuer, '89, 2498.

**HARBOR OF REFUGE AT FRONTBERG, N. Y.—(See FRONTBERG.)****HARBOR OF REFUGE, PORTAGE LAKE AND LAKE SUPERIOR SHIP CANAL.—(See PORTAGE LAKE AND LAKE SUPERIOR SHIP CANAL.)****HARBOR OF REFUGE AT SANDY BAY, CAPE ANN, MASS.—(See SANDY BAY, MASS.)****HARLEM RIVER, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 229.)

**Appropriations.**

1874-'79 .....	\$410,000
1888 .....	70,000, '88, 601.
1890 .....	250,000, '90, 712.
1892 .....	175,000, '92, 786.

Total ..... 905,000

List of appropriations, '88, 601; '91, 894.

**Contracts.**

1888. J. Satterlee, for excavation above and below mean low water, at 93 cents and \$1.13 per cubic yard, respectively, '88, 602. E. L. Richardson, for timber, '88, 602. J. Temines, for drift bolts, '88, 602.

1889. J. Satterlee, for dredging, at 40 cents per cubic yard, '89, 772.

**HARLEM RIVER, N. Y.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 59; '89, 74; '90, 65; '91, 84; '92, 88.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. McFarland, 1885-'89. Report, '88, 598.

Lieut. Col. G. L. Gillespie, 1889-'—. Reports, '89, 767; '90, 705; '91, 886; '92, 778.

**Operations.**

1887-'88. 43,488 cubic yards material dredged, '88, 600. Experimental crib constructed, '88, 601.

1888-'89. 152,973 cubic yards material dredged; 99 feet crib work built, and 1,929 cubic yards stone filling placed, '89, 769, 770.

1889-'90. 264,512 cubic yards material dredged, '90, 707.

1890-'91. 116,076 cubic yards material dredged and 2,487 cubic yards rock excavated from the channel, '91, 891.

1891-'92. 40,063 cubic yards rock excavated and 241,730 cubic yards material dredged from the channel; 1,152 cubic yards dry stone wall and 2,095 cubic yards wall laid in mortar built; 100 linear feet of crib-work revetment and 90 feet of pile-work revetment built, '92, 784.

**Obstructions.**

Bridges in Harlem River, '91, 889; '92, 780.

**Physical Characteristics.**

Description of the river, '88, 598; '92, 784, 785.

**Projects.**

By Col. Newton, 1875, for a channel 15 feet deep at mean low water from Randall's Island, by way of Spuyten Duyvil Creek, to the Hudson River, including the removal of rock obstructions around piers of High Bridge, excavation of canal prism, dredging, and revetment, the width of the channel to be 400 feet, except through Dyckmans Meadows, where it is reduced to 350 feet; estimated cost, \$2,100,000, '75, ii, 236, 237; '84, 705; '85, 676. For the improvement of Harlem River between this proposed channel and its mouth, \$600,000, '75, ii, 237; '85, 676. Aggregate estimated cost of entire improvement, \$2,700,000, '75, ii, 237; '85, 676; '86, 674; '87, 668.

History of project, '87, 666.

**HARRISECKET RIVER, ME.—IMPROVEMENT OF..**

(Continued from Vol. II, p. 230.)

**Appropriations.**

1890..... \$10,000, '91, 595.

1892..... 16,000, '92, 517.

Total ..... 26,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 31; '91, 26; '92, 31.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1889-'92. Reports, '89, 550; '91, 534.

Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 516.

**Operations.**

1889-'92. No operations; expenditure postponed to await appropriation of sufficient funds for the accomplishment of the work, '92, 517.

**Physical Characteristics.**

Description of the locality, '89, 551.

**Projects.**

By Lieut. Col. Smith, 1889, for improvement of the harbor entrance by excavation of a channel 60 feet wide and 14 feet deep at mean low water, and construction of wing dams; estimated cost, \$36,000, '89, 551; '92, 516.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Smith, '89, 550.

**HELL GATE, N. Y.—(See EAST RIVER, N. Y.)**

**HIAWASSEE RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 232.)

**Appropriations.**

1876-'87 .....	\$34,000
1888 .....	1,000, '88, 1606.
1890 .....	1,500, '90, 2131.

Total .....	36,500
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List of appropriations, '89, 1834; '91, 2260.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 209; '89, 244; '90, 220; '91, 280; '92, 267.

ENGINEERS IN CHARGE.

Lient. Col. J. W. Barlow, 1886-'92. Reports, '88, 1605; '89, 1833; '90, 2130; '91, 2259.

Lient. Col. H. M. Robert, 1892-'—. Report, '92, 1920.

**Operations.**

1887-'89. No operations, '88, 1605; '89, 1834.

1889-'90. 476 logs and snags removed from the channel, and 955 trees cut from the banks, '90, 2130.

1890-'91. No operations, '91, 2260.

1891-'92. 65 overhanging trees cleared from the banks, and repairs made to plant, '92, 1921.

**Projects.**

By Lient. Col. McFarland, 1874, for a channel 40 feet wide and 2 feet deep at low water from mouth to Savannah, for a distance of 33 miles; estimated cost, \$20,000, '75, i, 810, 813. Reestimate, \$30,000, '78, 762; '79, 140, 1269. Increased by Maj. King, in 1882, to \$34,000, '82, 1848; and in 1885 to \$36,500, '85, 1764; '87, 1755; '91, 2261; '92, 1920.

**HINGHAM HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 233.)

**Appropriations.**

1886-'87 .....	\$6,000
1888 .....	5,000, '88, 457.
1890 .....	5,000, '90, 507.
1892 .....	3,000, '92, 586.

Total .....	19,000
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**Contracts.**

1888. G. W. Townsend, for rock removal, at \$25 per cubic yard, and removal of loose overlying material, at \$9 per cubic yard, '89, 582.

1890. A. R. Wright, for dredging, at 18 cents per cubic yard, '91, 658.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 29; '89, 39; '90, 34; '91, 42; '92, 48.

ENGINEERS IN CHARGE.

Lient. Col. G. L. Gillespie, 1887-'89. Report, '88, 456.

Lient. Col. S. M. Mansfield, 1889-'—. Reports, '89, 580; '90, 506; '91, 656; '92, 585.

**Operations.**

1887-'88. No operations, '88, 456.

1888-'89. 80 cubic yards rock removed, '89, 581.

1889-'90. 93 cubic yards rock removed, '90, 507.

1890-'91. 20,400 cubic yards material dredged, '91, 565.

1891-'92. No operations, '92, 586.

**Projects.**

The original project of 1874 provided for an improved channel on the east side of Sailors Island, past the west side of Beacon to the Hingham Wharf, 100 feet wide and 8 feet deep at mean low water, at an estimated cost of \$11,000. This project was modified January 20, 1885, when it was proposed to deepen the improved channel to 10 feet at mean low water, and to remove a mid-channel ledge lying between Chandlers and Ragged islands, measuring 128 cubic yards, at a total cost of \$18,700, '88, 457.

**Surveys.**

MAPS.

'88, 456.

**HOMOSASSA RIVER, FLA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 174.

ENGINEER IN CHARGE.

Capt. W. M. Black, 1888. Report, '89, 1353.

ASSISTANT.

Lieut. D. D. Gaillard. Report, '89, 1354.

**Physical Characteristics.**

Description of the locality, '89, 1354.

**Plans.**

In 1889 Capt. Black considered the existing transportation facilities sufficient for the commerce of the locality, and did not recommend any works of improvement, '89, 1353.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Black, '89, 1353.

**HOSPITAL POINT, VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 120.

ENGINEER IN CHARGE.

Lieut. G. J. Fiebeger, 1888. Report, '89, 964.

**Physical Characteristics.**

Description of the locality, '89, 964.

**Plans.**

In 1889 Col. Craighill did not consider the locality worthy of improvement, '89, 968.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Fiebeger, '89, 964.

**HOUSATONIC RIVER, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 235.)

**Appropriations.**

1870-'87 .....	\$73,500
1888.....	35,000, '88, 552.
1890.....	35,000, '90, 634.
1892.....	20,000, '92, 683.

Total ..... 163,500

List of appropriations, '88, 553; '90, 634; '91, 776.

**Contracts.**

1889. R. Parrott, for hire of dredging plant, at \$8.50 per hour, '89, 692. Wm. H. Morton, for riprap granite, at \$1.49 per ton, '89, 692.

1890. Brown & Fleming, for breakwater extension, at a total of \$26,600, '91, 777. R. Parrott, for hire of dredging plant, at \$16 per hour, '91, 777.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 50; '89, 62; '90, 56; '91, 69; '92, 73.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1886'—. Reports, '88, 551, 554; '89, 688; '90, 631; '91, 773; '92, 680.

**Operations.**

1887-'88. Removal of Drews Rock and Jetty completed to a depth of 7 feet mean low water; tidal observations taken, '88, 532.

1888-'89. No operations, '89, 690.

1889-'90. 5,063 tons of granite riprap delivered in breakwater; 35,674 cubic yards material dredged, '90, 633, 634.

1890-'91. 7,443 tons of stone delivered in the breakwater, completing 2,090 linear feet; 2,176 cubic yards material dredged, '91, 775.

1891-'92. 17,150 tons riprap granite placed in the breakwater, extending the same 1,282 feet; 13,613 cubic yards material dredged, '92, 682.

**HOUSATONIC RIVER, CONN.—Continued.****Physical Characteristics.**

Description of the river, '88, 551.

**Projects.**

In 1871 Maj. G. K. Warren proposed the formation of a channel 100 feet wide and 7 feet deep from Derby to Long Island Sound, by dredging and the construction of jetties; also the formation and protection of a dredged channel at the mouth by a breakwater from Milford Beach; estimated cost, \$404,961, '71, 781, 783, 786; '86, 642; '87, 606.

In 1879 Maj. Barlow proposed a riprap jetty in place of the previously proposed breakwater, '79, 345; '87, 607.

In 1884, after an aggregate appropriation of \$71,200, Lieut. Col. McFarland proposed the removal of Drews Rock and the construction of the riprap jetty as per previous projects; estimated cost, \$30,000, '87, 607.

By Col. Houston, 1887, for the extension of a riprap breakwater from Milford Beach to the 12-foot curve of depth, and the dredging of a channel 7 feet deep and 200 feet wide through the bar at the mouth of the river, and thence to Derby a channel 100 feet wide; estimated cost, \$202,000, '87, 608; '91, 774; '92, 681.

**HUDSON HARBOR, WIS.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 274, 2218.

ENGINEER IN CHARGE.

Maj. W. A. Jones, 1891. Report, '91, 2219.

**Physical Characteristics.**

Description of the locality, '91, 2219.

**Plans.**

In 1891 Maj. Jones did not consider the locality worthy of improvement, '91, 2220.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Jones, '91, 2221.

**HUDSON RIVER, N. Y., between New Baltimore and Troy.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 236.)

**Appropriations.**

1834-'87 .....	\$1, 473, 538
1888 .....	75, 000, '88, 593.
1890 .....	150, 000, '90, 696.
1892 .....	187, 500, '92, 746.

Total ..... 1, 886, 038

List of appropriations, '88, 593; '90, 696; '91, 873.

**Commerce.**

Estimated annual valuation of, '89, 759.

Amount and value of the commerce of the Hudson River, '90, 698; '92, 761.

**Contracts.**

1890. Wm. Fuller & Sons, for pine piles, at 11½ cents per linear foot; round timber, at 7½ cents per linear foot; square timber, at \$39 per M feet, B. M.; for spike and wire, at 3½ cents per pound; for rubble stone, at 94 cents per cubic yard, and large stone, at \$1.28 per cubic yard, '90, 698.

1891. Wm. Fuller & Sons, for dike construction and repair, at a total of \$36,054, '91, 876. P. W. Myers, for dredging, at 14½ cents per cubic yard; E. M. Payne, for dredging, at 17½ cents, 11½ cents, and 21.9 cents per cubic yard, '91, 869.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 57; '89, 71; '90, 63, 332; '91, 81; '92, 84, 751.

BOARD OF ENGINEERS.

Harbor-line Board convened, March 18, 1890, by S. O. No. 49, at New York City, to examine and report upon location of harbor lines in the Hudson River from Troy to New Baltimore. Report, '90, 770, 772. (Cols. Abbot, Craighill, and Comstock, and Lieut. Col. Gillespie.)

Convened at New York, October 1, 1891, by S. O. No. 66, to report upon improvement of the Hudson River. Report, '92, 752. (Lieut. Col. Gillespie and Majs. Stickney and Raymond.)

# HUDSON RIVER, N. Y., between New Baltimore and Troy— Continued.

## Engineers—Continued.

### ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1885-'89. Report, '88, 588.

Lieut. Col. G. L. Gillespie, 1889-'— Reports, '89, 756; '90, 688, 766, 768; '91, 864; '92, 734.

## Obstructions.

Complaints by Albany State Board of Pilots as to illegal dumping in the river, '90, 690, 770.

List of bridges across the Hudson River, '90, 692; '91, 867; '92, 737.

## Operations.

1887-'88. Repairs to west dike, New Baltimore, and middle dike at Coeymans, '88, 590.

1888-'89. No operations, '89, 758.

1889-'90. 23,582 cubic yards stone used in repair of dikes, '90, 694.

1890-'91. 18,112 cubic yards stone used in dike construction and repair; 65,000 cubic yards material dredged, '91, 870, 871.

1891-'92. Mulla Plaat Dike extended 800 feet; Mulla Dike extended 2,535 feet; Nine Mile Tree Dike completed to a length of 1,735 feet; 5,600 cubic yards stone, 5,213 linear feet pine piling, and 6,974 feet, B. M., of square timber used in repairs to existing dikes; 52,327 cubic yards material dredged at Mulla Cross Over, Kellogg, Westington, Overslaugh, New Baltimore, and Stone Light bars; 1,372 cubic yards rock removed at Dettinger and Overslaugh Rocks, '92, 739, 743.

## Physical Characteristics.

Drainage area of the Hudson River; greatest, least, and average rainfall from 1827 to 1890; mean rise and fall of tides at various points along the river; elevation of mean tide at Albany above that of the Atlantic Ocean; heights of greatest known freshets above plane of mean low water at Albany, '90, 691; '91, 866.

## Projects.

The original and revised projects, under which the present works for the improvement of the river are conducted, were proposed by Col. Newton in 1866 and 1867, and provide for securing a navigable channel 11 feet deep at mean low water from New Baltimore up to Albany, and 9 feet deep at mean low water from Albany up to Troy. This project in detail is as follows: First, a system of longitudinal dikes to confine the current sufficiently to allow the ebb and flow of the tidal current to keep the channel clear; these dikes to be brought gradually nearer together from New Baltimore toward Troy; second, dredging where necessary; third, keeping the side reservoirs open to the passage of tidal currents, by gaps at their lower extremities, in order to increase the tidal flow; fourth, constructing dikes of timber and stone. The original estimated cost of this improvement was \$862,297.75; this estimate was increased several times at later periods, to take account of expenditures for repairs and for work done not included in previous estimates; it was revised in 1867 to \$984,304.47, '68, 718, 719; '87, 667. Increased in 1882, to cover repairs, by \$78,000, '82, 643; '86, 667. For removal of rock, 1884, by Capt. Mercur, \$16,000, '84, 696. Increasing the estimated cost to \$1,078,304.47, '86, 667; '87, 651, 656.

From 1864 to 1886, inclusive, \$1,053,538 was appropriated.

In 1887 Lieut. Col. McFarland considered that \$255,000 would yet be required to complete the permanent works and make needed repairs to existing dikes, '87, 653, 655, 656.

In 1889 this estimate was increased to \$295,000 over and above prior appropriations, '89, 760.

By Board of Engineers, 1891, for excavation of a channel 12 feet deep and 400 feet wide from Coxsackie to the foot of Broadway, Troy, and thence 12 feet deep and 300 feet wide to the State Dam at Troy; estimated cost, \$2,447,906.56, '92, 752, 759.

# HUDSON RIVER, N. Y., between New Baltimore and Coxsackie.—SURVEY OF.

## Engineers.

### CHIEF OF ENGINEERS.

Report, '88, 68.

### ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1887. Report, '88, 640.

Lieut. Col. G. L. Gillespie, 1888. Reports, '88, 641; '91, 864.

### ASSISTANT.

M. Kingsley. Report, '88, 642.



**HUDSON RIVER, N. Y., between New Baltimore and Cox-sackie—Continued.****Physical Characteristics.**

Description of the river, '88, 640.

**Projects.**

Inasmuch as a sufficient depth already exists between New Baltimore and Cox-sackie, Lieut. Col. Gillespie did not consider further improvement necessary, '88, 642.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Lieut. Col. Gillespie, '88, 641.

**MAPS.**

'88, 642.

**HULLS CREEK, VA.—EXAMINATION OF.**

(Continued from Vol. II, p. 239.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 134.

**ENGINEER IN CHARGE.**

S. T. Abert, U. S. agent, 1888. Report, '89, 1025.

**Physical Characteristics.**

Description of the locality, '89, 1026.

**Plans.**

In 1888 Mr. S. T. Abert did not consider Hulls Creek as worthy of improvement, '89, 1027.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Mr. S. T. Abert, '89, 1025.

**HUMBOLDT HARBOR AND BAY, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 239.)

**Appropriations.**

1881-'87 .....	\$217,500
1888.....	125,000, '88, 2135.
1890.....	80,000, '90, 2921.
1892.....	150,000, '92, 2658.

Total ..... 572,500

List of appropriations, '92, 2658.

**Commerce.**

Freight and passenger travel to be influenced by improvement, '91, 3124.

**Contracts.**

1888. American Bridge and Building Company, for training-wall construction, at \$171,350, '89, 2490.

1891. Simpson & Brown, for jetty construction, at a total of \$157,950, '91, 3121.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 296; '89, 351; '90, 316; '91, 397, 427; '92, 373.

**BOARD OF ENGINEERS.**

Convened at San Francisco, March 13, 1891, by S. O. No. 72, to consider and report upon project for improvement of Humboldt Bay. Report, '91, 3129. (Col. Mendell, Lieut. Col. Benyard, and Maj. Heuer.)

Convened at San Francisco, June 8, 1891, by S. O. No. 55, to report upon establishment of harbor lines in Humboldt Bay. Report, '91, 3141. (Col. Mendell, Lieut. Col. Benyard, and Maj. Heuer.)

**ENGINEER IN CHARGE.**

Maj. W. H. Heuer, 1888.— Reports, '88, 2135; '89, 2490; '90, 2918; '91, 3120, 3138, 3140; '92, 2658.

**Operations.**

1887-'88. No operations, '88, 2135.

1888-'89. 1,152 linear feet shore protection built, containing 1,672 cubic yards brush and 2,748 tons rock, '89, 2491.

1889-'90. 24,512 tons rock and 14,669 cubic yards brush delivered in the jetty, and 2,767 linear feet of pier built, '90, 2919.

**HUMBOLDT HARBOR AND BAY, CAL.—Continued.****Operations—Continued.**

1890-'91. 8,168 tons of rock placed in the jetty; wharf and approaches built on north spit, '91, 3122.

1891-'92. 300 linear feet of brush and stone shore protection built at north spit; 8,777 cubic yards brush mattress and 15,930 tons stone placed in north jetty; 4,759 cubic yards brush mattress and 30,778 tons stone placed in south jetty; 1,486 linear feet track way laid in stone, and trestle and track over the water extended 1,480 feet, '92, 2658.

**Physical Characteristics.**

Description of the locality, '91, 3129.

**Projects.**

By Lieut. Col. Mendell, 1881, for securing, by dredging, a channel 13 feet deep and 200 feet wide to the upper end of Eureka Wharves, with channel 100 feet wide and 10 feet deep to Arcata and Hookton; estimated cost, \$135,220, '81, 2480, 2488.

In 1882, after the appropriation of \$80,000, Lieut. Col. Mendell proposed to obtain an increased depth of channel across the outer bar by a training wall about 6,000 feet long from the south spit, running in a northerly direction; estimated cost, \$600,000, '83, 1991. Approved by the Board of Engineers of 1882, '83, 1992; '87, 2447.

In 1890 the existing project was modified to embrace shore-protection work on the north spit, and the construction of a jetty starting from there and running seaward nearly parallel to the jetty on the south spit, both jetties to extend out to the 18-foot contour, and be raised to the plane of high water; estimated cost of completing project, \$1,715,115, '91, 3121; '92, 2658.

**Surveys.****MAPS.**

'91, 3122, 3131.

**HUNTING CREEK, VA.—EXAMINATION OF.**

(Continued from Vol. II, p. 240.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 134.

**ENGINEER IN CHARGE.**

S. T. Abert, U. S. agent, 1888. Report, '89, 1028.

**Plans.**

In 1888 Mr. S. T. Abert did not consider that existing commercial necessities warranted the improvement of Hunting Creek, '89, 1028.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Mr. S. T. Abert, '89, 1028.

**HUNTINGDON HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 241.)

**Appropriations.**

1872-'87 .....	\$22,500
1890.....	10,000, '91, 819.
1892.....	5,000, '92, 719.

Total ..... 37,500

**Contracts.**

C. & H. E. Du Bois, for dredging, at 15.9 cents per cubic yard, '91, 819.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 76; '92, 81.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1890-'— . Reports, '91, 817; '92, 717.

**Operations.**

1891-'92. 55,137 cubic yards material dredged, '92, 718.

**Projects.**

By Col. McFarland, 1885, for the formation of a dredged channel 100 feet wide and 8 feet deep at low water on the bar, the widening of the channel near the wharves, and the protection of the channel by a pile revetment 1,400 feet long; estimated cost, \$32,000, '85, 705; '91, 817; '92, 718.

**HURON HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 241.)

**Appropriations.**

1826-'87 .....	\$117, 273. 71
1888 .....	6, 000. 00, '88, 1998.
1890 .....	16, 000. 00, '90, 2773.
1892 .....	15, 000. 00, '92, 2499.

Total ..... 154, 273. 71

List of appropriations, '92, 2499.

**Contracts.**

1889. Stang &amp; Kerr, for pier repair, at a total of \$4,685.20, '89, 2315. W. St. John &amp; Son, for dredging, at 28 cents per cubic yard, '89, 2313.

1890. J. Stang, for repairs to piers, at a total of \$5,270, '91, 2845. Carlin, Stickney &amp; Cram, for dredging, at 25 cents per cubic yard, '91, 2847.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 272; '89, 324; '90, 293; '91, 367; '92, 347.

ENGINEERS IN CHARGE.

Maj. L. C. Overman, 1883-'92. Reports, '88, 1997; '89, 2313; '90, 2772; '91, 2843.

Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2498.

**Operations.**

1887-'88. No operations, '88, 1997.

1888-'89. Pier repair under contract begun; 1,366 cubic yards material dredged, '89, 2313.

1889-'90. Pier repair continued, '90, 2772.

1890-'91. 8,092 cubic yards material dredged; repairs to piers and extension of west pier, '91, 2844.

1891-'92. West pier extended 120 feet; minor repairs to superstructure of old piers, '92, 2499.

**Projects.**

The project adopted in 1826 and modified in 1871 proposed the extension of 2 parallel piers 140 feet apart, the object being to afford a channel of entrance not less than 14 feet deep, '80, 2127; '85, 332. Between 1826 and 1880 \$101,273.71 had been appropriated, '80, 2121.

In 1879 Maj. Wilson proposed rebuilding the superstructure to both piers and reconstruction of a short breakwater at the shore end of the west pier; estimated cost, \$25,000, '79, 1686; '80, 2121. Increased in 1885 by \$6,500, '85, 2220; '87, 2308.

By Maj. Overman, 1890, to secure a 17-foot channel depth by extension of piers to the 17-foot curve in the lake; estimated cost of extension, with necessary dredging, \$40,000, '90, 2773; '92, 2498.

**Surveys.**

MAPS.

'91, 2845.

**HURON (LAKE), Harbor of Refuge on.—(See SAND BEACH, LAKE HURON.)****HYANNIS HARBOR BREAKWATER, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 242.)

**Appropriations.**

1827-'87 .....	\$133, 431. 82
1888 .....	10, 000. 00, '88, 485.
1890 .....	8, 000. 00, '90, 553.
1892 .....	6, 000. 00, '92, 599.

Total ..... 157, 431. 82

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 33; '89, 44; '90, 38; '91, 48; '92, 53.

**HYANNIS HARBOR BREAKWATER, MASS.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1887-'92. Reports, '88, 484; '89, 606; '90, 552; '91, 694.

Capt. W. H. Bixby, 1892-'— Report, '92, 598.

**Operations.**

1887-'88. 21,389 cubic yards material dredged, '88, 484.

1888-'89. No operations, '89, 606.

1889-'90. Dredging begun in the 15½-foot area, '90, 552.

1890-'91. 22,100 cubic yards material dredged, '91, 694.

1891-'92. 6,360 cubic yards material dredged, '92, 598.

**Projects.**

The original project was for a breakwater of riprap stone 1,170 feet in length, covering an anchorage area of about 175 acres and having an entrance depth of 15 feet. This was commenced in 1827 and completed in 1838, at a cost of \$70,931, '80, 366; '86, 586, 619.

By Maj. Warren, 1873, for increasing width of base of breakwater and otherwise strengthening it; estimated cost, \$25,000, '73, 86, 948, 949.

By Lieut. Col. Elliot, 1885, for increasing the depth of the anchorage area within the harbor; estimated cost, \$45,743.20, '85, 621; '86, 586; '87, 592; '92, 598.

**ILLINOIS RIVER, ILL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 245.)

**Appropriations.**

1852-'87 .....	\$1,366,650
1888 .....	200,000, '88, 1891.
1890 .....	200,000, '90, 2410.
1892 .....	100,000, '92, 2259.

Total ..... 1,866,650

**Commerce.**

Commercial advantages of a waterway between the Great Lakes and the Mississippi River, '90, 2454.

List of merchant steamboats navigating the Mississippi and its tributaries, with drafts from 7 to 9 feet and less, '90, 2538, 2540.

Lockages and tonnage passing La Grange Lock for 1892, '92, 2296, 2297.

**Contracts.**

1891. Sanger & Moody, for furnishing and delivering stone, '92, 2261.

1892. Russell Wheel and Foundry Company, for iron and steel lock-gate fittings, at \$9,850.65; H. B. Wyeth, for yellow pine timber, at \$19 per M feet, B. M.; A. R. Beck Lumber Company, for pine lumber, at \$18.70, and pine plank, at \$16.95 per M feet, B. M., '92, 2260.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 249; '89, 289; '90, 261; '91, 332; '92, 318, 319, 335.

**ENGINEER IN CHARGE.**

Capt. W. S. Marshall, 1888-'— Reports, '88, 1889; '89, 2120; '90, 2407, 2419, 2454, 2574; '91, 2611, 2630; '92, 2255, 2294, 2656, 2660.

**ASSISTANTS.**

G. B. Hegardt. Report, '88, 1892.

W. M. Childs. Reports, '89, 2126; '90, 2410; '91, 2626, 2631.

L. L. Wheeler. Reports, '89, 2127; '90, 2456.

C. V. Brainard. Report, '92, 2261, 2295.

**Legislation.**

Chicago drainage and waterways laws, '89, 2134; '90, 2449, 2550.

**Operations.**

1887-'88. Lock at La Grange completed; 2,881 cubic yards cut stone delivered; 26,061 cubic yards material dredged from the channel, '88, 1890.

1888-'89. La Grange Dam begun; 1,284 cubic yards cut stone and 2,300 cubic yards backing stone received from Kampsville Lock, '89, 2122.

1889-'90. La Grange Lock and Dam completed; work continued upon the Kampsville Lock and Dam, '90, 2408.

1890-'91. Repairs to La Grange Lock and Dam; preparations for laying up Kampsville Lock; repairs to plant, '91, 2612.

**ILLINOIS RIVER, ILL.—Continued.****Operations—Continued.**

1891-'92. 212 linear feet of revetment and an ice breaker built at La Grange Lock and Dam, and 12,500 cubic yards material dredged from lock approaches; 9,000 cubic yards material dredged at Kampsville Lock site; 1,170 linear feet of trestle completed; 10,145 cubic yards masonry laid in lock walls; 27,479 cubic yards material dredged above and below lock pit, '92, 2257. Operation and care of La Grange Lock and Dam, '92, 2294.

**Physical Characteristics.**

Discharges of Illinois River and Illinois and Michigan Canal, '89, 2132, 2133; '90, 2409, 2443.

Gauge readings on the Illinois River at Kampsville from 1881 to 1889, '90, 2414. Above Copperas Creek Dam, Illinois, from 1879 to 1890, '90, 2520. At La Grange, from 1883 to 1890, '90, 2532.

Overflow stage of Illinois River, '90, 2443.

Effects of definite increased discharge upon channel depths, '90, 2444.

Average length of time that the dams upon the Illinois are necessary for navigation, '90, 2446.

Influence of dams upon flood heights and upon flowage of lands, '90, 2447.

Borings upon proposed routes between Chicago and Sag Bridge, '90, 2461, 2482.

Elevations of high waters between Joliet and La Salle, '90, 2515.

Lake Michigan water levels from 1860 to 1890, '90, 2517, 2518.

Discharge observations on Illinois River at Ottawa, Ill., '90, 2536. At Kampsville, 1891, '92, 2263.

Gauge readings at Copperas Creek and La Grange and Kampsville locks, 1891, '92, 2267, 2269.

**Plans.**

By Capt. Marshall, 1890, for excavation of a canal from Lake Michigan to Sag Bridge; width of canal to be 160 feet; estimated cost by the Chicago route, for a 14-foot depth, \$10,689,591; for an 8-foot depth, \$8,791,056; for a 14-foot depth by the Sag route, \$8,501,041; for an 8-foot depth, \$5,793,303, '90, 2419, 2422, 2425, 2428, 2429, 2430, 2431.

Total estimate for the two projects from Lake Michigan through to La Salle: For the 14-foot project via Chicago route, \$48,282,763; via Sag route, \$46,094,213; for the 8-foot project via Chicago route, \$26,883,153; via Sag route, \$23,885,400, '90, 2433.

Comparative advantages of the two routes from Sag Bridge to Lake Michigan, '90, 2435.

Detailed report upon surveys and estimates for the above proposed waterways, '90, 2456.

**Projects.**

Previous to 1880 efforts on the part of the General Government for the improvement of the river consisted in the construction of wing dams and dikes, dredging through the worst bars, and the construction of the foundation of the Copperas Creek Lock, the State of Illinois undertaking the building of locks and dams, and the United States the improvement of the river bed, '71, 247; '73, 473; '74, i, 340; '75, i, 467; '86, 380.

The amount thus expended from 1868 to June 30, 1880, was \$550,000, '80, 1994, 1999; '86, 308.

The act of June 14, 1880, required that \$100,000 of the \$110,000 appropriated should be applied to the construction of locks and dams at La Grange and Kampsville and the dredging of the river channel where needed between Copperas Creek Dam and mouth of river to obtain a low-water depth of 7 feet, '81, 2176, 2177. Estimated cost of the two locks and dams, \$680,000; for dredging, brush dams, and shore protection, \$270,850, '81, 2177, 2181; '82, 2246.

In 1883 the estimate for locks and dams was increased to \$850,000, '83, 1753.

From 1880 to 1886, inclusive, \$747,500 was appropriated. In 1887 it was estimated that \$587,500 would be required to complete the project, '87, 2124. Increased in 1889 by \$25,000, '89, 2126.

**Surveys.**

Survey for waterway between Lake Michigan and the Mississippi River ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Marshall, '89, 2123, 2127, 2419.

Survey of Illinois River, from La Salle to the Mississippi, with a view to ascertaining lands subject to overflow by the construction of a waterway between Lake Michigan and the Mississippi, ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Marshall, '91, 2661.

**MAPS.**

'89, 2122, 2134, 2140; '90, 2613.

**ILLINOIS AND MISSISSIPPI CANAL, ILL.—CONSTRUCTION OF.****Appropriations.**

1880..... \$500,000, '91, 2633.  
 1892..... 500,000, '92, 2500.

Total ..... 1,000,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 293; '90, 263; '91, 334; '92, 320.

**BOARD OF ENGINEERS.**

Convened at Rock Island, September 12, 1891, by S. O. No. 48, to consider and report upon the location of the western terminus of the Illinois and Mississippi Canal. Report, '92, 2302. (Col. Poe, Maj. Mackenzie, and Capt. Marshall.)

**ENGINEER IN CHARGE.**

Capt. W. L. Marshall, 1889-'—. Reports, '89, 2148; '90, 2580, 2581, 2604; '91, 2633, 2640, 2646, 2650; '92, 2297.

**ASSISTANTS.**

G. A. M. Liljencrantz. Reports, '89, 2149; '90, 2601.

L. L. Wheeler. Reports, '91, 2643, 2653, 2655; '92, 2301.

**Operations.**

1888-'91. Preparations of drawings, plans, and estimates for the proposed canal, '89, 2148; '90, 2580; '91, 2633; '92, 2301.

**Physical Characteristics.**

Description of approved canal route, '90, 2582.

**Plans.**

Location of proposed canal and feeder routes, '90, 2588, 2589, 2609.

Dimensions of proposed canal and constructions proposed, '90, 2589.

Details of lock, bridge, sluice way, and dam construction, '90, 2590.

Itemized estimates of cost, '90, 2596.

General considerations relating to the work, '90, 2599; '91, 2639. Total estimated cost, \$6,925,960, '90, 2597; '92, 2300.

Western terminus of canal located by Board of Engineers, 1891, upon the south side of the principal mouth of Rock Island River, '92, 2310.

**Surveys.****MAPS.**

'91, 2649.

**INDIANA CHUTE.—(See OHIO RIVER, AT FALLS OF.)****INDIANOLA HARBOR, TEX.—(See MATAGORDA BAY.)****INDIAN RIVER, DEL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 246.)

**Appropriations.**

1882..... \$10,000

**Commerce.**

Prospective benefit of improvement to commerce, '88, 745.

**Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 744.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885-'—. Report, '88, 744.

**Operations.**

1887-'88. No operations since 1883 for lack of funds, '88, 744.

**Projects.**

By Capt. Ludlow, 1882, for improvement of river between its mouth and Millsboro, by excavation of a channel through "Bulkhead" Shoal, 3,000 feet long, 80 feet wide, and 4 feet deep; thence to the inlet, 2,000 feet in length, 150 feet wide, and 5 feet deep; the channel to be protected by a dike on its north side; estimated cost, \$50,000, '82, 833. Increased, in 1883, to \$60,000, '83, 650; '87, 835.

**INDIAN RIVER, FLA.—EXAMINATION BETWEEN TITUSVILLE AND JUPITER INLET.****Appropriations.**

1892..... \$15,000

**Commerce.**

Present and prospective commerce of the locality, '91, 1674.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 195, 1673.

ENGINEER IN CHARGE.

Capt. W. M. Black, 1890. Report, '91, 1673.

**Physical Characteristics.**

Description of the locality, '91, 1674.

**Plans.**

In 1891 Capt. Black reported the locality worthy of improvement on condition that the Florida Coast Line Canal and Transportation Company surrender to the United States all rights which it now holds under State charter, '91, 1675.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Black, '91, 1673.

**IPSWICH RIVER, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 248.)

**Appropriations.**

1886-'87 ..... \$2,500

1888..... 2,500, '88, 439.

1892..... 2,500, '92, 558.

Total ..... 7,500

List of appropriations, '89, 560.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 24; '89, 34; '90, 29; '91, 35; '92, 42.

ENGINEERS IN CHARGE.

Lieut. Col. G. L. Gillespie, 1887-'89. Report, '88, 438.

Lieut. Col. S. M. Mansfield, 1889-'—. Reports, '89, 559; '90, 487; '91, 631; '92, 557.

**Operations.**

1887-'90. No operations, the only bids made upon the work for both 1889 and 1890 being considered excessive, '88, 438; '89, 560; '90, 488; '91, 632; '92, 557.

**Projects.**

The original project for improvement was submitted December 6, 1875. It proposed a channel 60 feet wide and 4 feet deep, mean low water, from "Barras Turns" to the town wharves, at an estimated cost of \$25,000. On November 5, 1883, the original project was divided into three partial projects: (1) The removal of the ledges at Heards Point and opposite Nabby's Point to a depth of 2 feet, mean low water, to open a navigable channel of that depth, at a cost of \$15,900; (2) to dredge the shoals at "Labor in Vain" and "The Shoals," so as to open a channel 4 feet deep at mean low water and 60 feet wide, at a cost of \$2,200; (3) to straighten the channel by making a cut across "Barras Turns" and to build a jetty to close the old channel, at a cost of \$6,900. In the Annual Report of 1887 it was recommended that the general project be modified by limiting the present improvement to opening a channel 60 feet wide and 4 feet deep through "The Shoals" and "Labor in Vain" and extending it to the "Deep Hole," opposite the town wharves, '88, 438.

**IRONDEQUOIT BAY, LAKE ONTARIO, N. Y.—EXAMINATION FOR HARBOR OF REFUGE AT.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 337.

ENGINEER IN CHARGE.

Capt. C. F. Palfrey. Report, '89, 2425.

**IRONDEQUOIT BAY, LAKE ONTARIO, N. Y.—Continued.****Plans.**

In 1889 Capt. Palfrey did not consider, in view of the neighborhood of Charlotte Harbor, that a harbor of refuge was a necessity at Irondequoit Bay, '89, 2426.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Palfrey, '89, 2425.

**JAMAICA BAY AND LONG BEACH INLET, N. Y.—SURVEY FOR CANAL BETWEEN.****Appropriations.**

1892..... \$9,460

**Engineers.**

CHIEF OF ENGINEERS.

Report, '92, 97.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie. Report, '92, 840, 845.

ASSISTANT.

G. W. Kuehule. Report, '92, 847.

**Physical Characteristics.**

Description of the locality, '92, 841.

**Plans.**

By Lieut. Col. Gillespie, 1891, for excavation of a navigable waterway 60 feet wide and 5 feet deep at mean low water from Beach Channel to some point on the eastern shore of Jamaica Bay; three routes are submitted, at a cost, respectively, of \$21,406, \$18,920, and \$9,460, '92, 846, 847.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Gillespie, '92, 845.

**JAMES CREEK CANAL, D. C.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 107.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1887. Report, '88, 807.

**Physical Characteristics.**

Description of the locality, '88, 807.

**Plans.**

By Lieut. Col. Hains, 1887, for improvement of the lowlands in the vicinity of Washington Barracks, involving the filling in of low areas and the construction of retaining walls, at an estimated cost of from \$226,270 to \$514,000, '88, 809, 811.

**Surveys.**

Survey made, 1887, under direction of Lieut. Col. Hains, '88, 807.

MAPS.

'88, 810.

**JAMES RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 249.)

**Appropriations.**

1836-'87 .....	\$928,000
1888.....	225,000, '88, 762.
1890.....	200,000, '90, 992.
1892.....	200,000, '92, 1013.

Total ..... 1,553,000

List of appropriations, '92, 1013.



**JAMES RIVER, VA.—Continued.****Contracts.**

1888. American Dredging Company, for dredging, at 16 cents per cubic yard, '89, 935. Alabama Dredging and Jetty Company, for rock removal, at \$1.50 per cubic yard for disintegrated and \$6.33 per cubic yard for solid rock, '89, 935. John F. Gaynor, for mattress-dike construction, at \$2.47 and \$1.75 per linear foot, and for jetty construction, at \$2.47 per linear foot, '89, 936. H. T. Morrison, for construction of four scows for a lump sum of \$4,385, '89, 936. H. T. Morrison, for construction of lighter, at \$1,476.50, '89, 936. J. F. Bradley, for brush-dike construction, at 95 cents per linear foot, '89, 937.
1889. Wm. T. Gaynor, for brush-dike construction, at \$1.50 per linear foot, '90, 993.
1890. H. Brusstar & Bro., construction of scow, at \$1,305, '90, 994. W. H. Curtis, for mattress construction, at \$1.79 per linear foot, and jetty construction, at \$2.49 per linear foot, '91, 1236. C. D. Langhorne, for removal of disintegrated rock, at 45 cents and \$1.45 per cubic yard; removal of solid rock, at \$1.10 and \$6.15 per cubic yard; gravel excavation, at 16 cents and 25 cents per cubic yard, '91, 1236. C. T. Caler, for dredging, at 38 cents per cubic yard for disintegrated rock, 16½ cents for sand, and \$1.04 per cubic yard for solid rock removal, '91, 1237.
1891. J. T. Vaughan, for dredging, at 44 cents per cubic yard for sand, \$3 for bowlders, and \$1 per linear foot for logs, '91, 1237. C. D. Langhorne, for construction of railroad track, at a total of \$5,350, and transfer slip, at a total of \$3,000; Tredegar Company, for construction of one car, at \$325; H. T. Morrison & Co., for caisson construction, at \$2,476, '92, 1013.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 97; '89, 113; '90, 103, 333; '91, 134; '92, 134.

**BOARD OF ENGINEERS.**

Convened March 17, 1890, at Richmond, to consider and report upon the establishment of harbor lines in James River. Report, '90, 1013, 1016. Harbor lines as established by the Board, '90, 1016. (Col. Craighill, Lieut. Col. Hains, and Lieut. Fieberger.)

**ENGINEERS IN CHARGE.**

Col. W. P. Craighill, 1888—'. Reports, '88, 761; '90, 992, 1013; '91, 1234; '92, 1012.

Capt. Thos. Turtle, 1889-'90. Report, '89, 934.

**ASSISTANTS.**

C. P. E. Burgwyn. Reports, '88, 762; '89, 937; '90, 994; '91, 1237.

H. D. Whitcomb. Report, '92, 1014.

**Operations.**

- 1887-'88. 120,566 cubic yards of sand and gravel, 220 bowlders, and 7,064 cubic yards solid rock removed; 10,047 linear feet of training wall, 2,066 linear feet of new wing dam, and 1,016 linear feet of old wing dam built, '88, 762-765.
- 1888-'89. 509,078 cubic yards material dredged, 4,380 cubic yards rock removed, and 8,379 linear feet of training wall built, '89, 938.
- 1889-'90. 8,860 cubic yards rock removed; 78,336 cubic yards material dredged; 9,340 linear feet training wall built, '90, 994, 997.
- 1890-'91. 66,700 cubic yards rock removed; wing dam built at Wilton; 39,970 cubic yards material dredged at Kingsland, and 2,900 feet of training wall built, '91, 1241.
- 1891-'92. 101,825 cubic yards material dredged; 20,058 cubic yards loose rock and 6,265 cubic yards solid rock removed, '92, 1016.

**Physical Characteristics.**

Freshets in the James River, 1888-'89, '89, 941.

Comparison of freshet slopes, '89, 941.

Table showing the available draft of water at high tide throughout the improved portions of the river, '90, 997.

**Projects.**

The original project of 1870, together with its modifications to 1882, proposed to secure between Richmond and the sea a channel 180 feet wide and 18 feet deep at full tide, or about 15 feet deep at mean low water. It was to be secured by the removal of rock and bowlders, dredging on bars, and deposition of material behind rectifying dikes; excavation through Dutch Gap Cut-off and cut-offs near Jones Neck and Bermuda Hundred, '71, 604; '72, 691; '76, 1, 298; '79, 516, 520; '86, 138. The aggregate of the appropriations from 1870 to 1882, inclusive, was \$740,000.

**JAMES RIVER, VA.—Continued.****Projects—Continued.**

By Col. Craighill, 1882, for increasing previous widths and depths of channel so as to secure 25 feet at full tide, or 22 feet at half tide, between Richmond and the sea. The width of channels to be as follows: From mouth to City Point, 400 feet; from thence to Dreweys Bluff, 300 feet, and from thence to the city of Richmond, 200 feet; estimated cost, \$4,500,000, '82, 871, 876; '85, 947; '86, 138; '87, 867; '91, 1234.

**JEFFERSONVILLE, IND.—(See OHIO RIVER.)****JONESPORT, ME.—IMPROVEMENT OF MOOSABEC BAR AT.**

(See MOOSABEC RIVER AT JONESPORT, ME.)

**JUPITER INLET, FLA.—(See SAINT JOHNS RIVER.)****JEKYL CREEK, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 251.)

**Appropriations.**

1888.....	\$5,000, '89, 1272.
1890.....	7,500, '90, 1422.
1892.....	7,500, '92, 1286.

Total ..... 20,000

**Contracts.**

1888. P. S. Ross, for dredging, at 20 cents per cubic yard, '89, 1272.  
 1891. J. F. Gaynor, for training-wall construction, at a total of \$21,270, '91, 1559.  
 P. S. Ross, for dredging, at 24 cents per cubic yard, '91, 1559.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 142, 143; '89, 163; '90, 146; '91, 183; '92, 179.

**ENGINEERS IN CHARGE.**

Col. Q. A. Gillmore, 1880-'89. Report, '88, 1073, 1075.

Capt. O. M. Carter, 1889-'—. Reports, '89, 1270; '90, 1420; '91, 1556; '92, 1283.

**ASSISTANT.**

Lieut. O. M. Carter. Report, '88, 1076.

**Operations.**

1887-'88. No operations, '88, 1073, 1075.  
 1888-'89. 20,486 cubic yards material dredged, '89, 1271.  
 1889-'90. No operations, '90, 1421.  
 1890-'91. Training-wall construction begun, '91, 1557.  
 1891-'92. 13,000 cubic yards of material dredged, '92, 1284.

**Physical Characteristics.**

Description of the creek, '88, 1075.

**Projects.**

By Col. Gillmore, 1888, for the establishment and maintenance of a 7-foot low-water channel through the shoals in the creek by the construction of training wall at its mouth, the erection of a dam to close Mud River, and dredging; the dredged channels to have a bottom width of 50 feet; estimated cost, \$38,590, '90, 1421.

**Surveys.**

Survey ordered by act of August 5, 1886. Made, 1887, under direction of Col. Gillmore, '88, 1073, 1075.

**MAPS.**

'88, 1076; '89, 1272; '92, Atlas, 59.

**KANAWHA RIVER, GREAT, W. VA.—HARBOR OF REFUGE AT MOUTH OF.**

(Continued from Vol. II, p. 253.)

**Appropriations.**

1884..... \$15,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 223.

ENGINEER IN CHARGE.

Col. W. P. Craighill. Report, '88, 1759.

**Operations.**

1887-'88. No operations; project completed, '88, 1759.

**Projects.**

By Lieut. Col. Merrill, for the formation of a harbor of refuge at the mouth of the Great Kanawha by the construction of 3 ice piers, at an estimated cost of \$15,000, '84, 1827; '86, 1550; '87, 1822.

**Surveys.**

MAPS.

'92, Atlas, 100.

**KANAWHA RIVER, GREAT, W. VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 251.)

**Appropriations.**

1873-'88 ..... \$2,020,337  
 1888 ..... 350,000, '88, 1750.  
 1890 ..... 300,000, '90, 2238.  
 1892 ..... 225,000, '92, 2045.

Total ..... 2,895,337

List of appropriations, '92, 2042.

**Contracts.**

1887. Ainslie, Cochran & Co., for ironwork, at \$4,184, '88, 1750. W. D. Lewis, for timber, at \$26 per M feet, '88, 1751.

1888. D. Eagan, for completing Lock House No. 2, at \$516, '88, 1751. D. Eagan, for construction of lock house and outbuildings, at \$2,606, '89, 1942. L. Williams, for constructing guard cribs at Lock No. 2, at \$1,328, '89, 1943. Carkin, Stickney & Cram, for constructing Lock No. 7, at \$136,095, '89, 1944.

1889. L. Williams, for constructing dump boat, at \$1,405.50, '89, 1944. C. T. McDonald, for construction of Lock No. 8, at \$123,935, '90, 2239. Queen City Bridge and Steam Forging Company, for lock ironwork, at \$3,751, '90, 2239.

1890. Mumford & Reynolds, for construction of Dam No. 7, at \$113,515, '91, 2415.

1891. Russell Wheel and Foundry Company, for ironwork for anchorage and fixed parts of movable dams Nos. 7 and 8, at \$11,750.50, '91, 2416.

1892. F. J. Myers Manufacturing Company, for ironwork, at \$29,025.85, '92, 2045.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 222, 223; '89, 258, 260; '90, 232, 233; '91, 299, 300; '92, 286, 287.

ENGINEERS IN CHARGE.

Col. W. P. Craighill, 1874-'—. Reports, '88, 1749, 1756; '90, 2237, 2246; '91, 2413, 2425; '92, 2041, 2062.

Capt. T. Turtle, 1889. Report, '89, 1941, 1954.

ASSISTANT.

A. M. Scott. Reports, '88, 1751; '89, 1945, 1952; '90, 2240; '91, 2417; '92, 2045.

**Operations.**

1887-'88. Lock and Dam No. 2 completed and put in operation; banks riprapped at Lock No. 3; repairs to lock; two sunken barges in the Charleston Pool and one near Lock No. 3 removed; repairs to plant, '88, 1751, 1755. Operation and care of locks and dams, '88, 1756.

1888-'89. 2,180 cubic yards riprap used in repair of banks at Lock and Dam No. 2; cribs built at head of Lock No. 2, and lock house completed; minor repairs to movable dams; lock house built, and construction of Lock No. 7 begun; dredging at Lock No. 2, Harveys Shoal, Wickers Creek Shoal, Scary Shoal, '89, 1945, 1949. Operation and care of locks and dams, '89, 1954.

1889-'90. Cofferdams, excavation, and foundation for Lock No. 7 completed, and main walls begun; construction of Lock No. 8 begun; lock house built; 2,813 cubic yards riprap placed in repair of Lock No. 2; new lower gates placed in Lock No. 3, and repairs to locks 4, 5, and 6 of the movable dams; dredging and snag removal, '90, 2240-2245. Operation and care of locks and dams, '90, 2246.

**KANAWHA RIVER, GREAT, W. VA.—Continued.****Operations—Continued.**

1890-'91. Excavation for foundations; 528 cubic yards concrete and 104 cubic yards masonry laid; preparation of material for dam at Lock and Dam No. 7; 4,500 cubic yards masonry laid in construction of Lock and Dam No. 8. Operation and repair of locks and dams, '91, 2417-2425.

1891-'92. Locks 7 and 8 completed (except gates), and foundations for dams 7 and 8 in progress; repairs to locks 4 and 5; dredging and repairs to plant, '92, 2045, 2052. Operation and care of locks and dams, '92, 2062.

**Physical Characteristics.**

Compressive strength, specific gravity, and ratio of absorption of Great Kanawha sandstones, '89, 1951.

**Projects.**

By Lieut. Col. Craighill, 1875, for improvement, as revised by Board of Engineers, from mouth to Great Falls, 97 miles, to secure a low-water depth of from 6 to 7 feet by a combination of permanent and movable dams (see Index, Vol. I, pp. 263, 265); omission of Lock and Dam No. 1, '79, 550. Recommendation of Board of Engineers of 1882, '82, 828, 829.

In 1886 locks and dams Nos. 3, 4, and 5 were completed, and Lock and Dam No. 6, with No. 2, nearly completed, '86, 280.

Amount appropriated for permanent improvement, \$1,929,500; amount required to complete project, \$1,670,000, '86, 281.

In 1889 the amount estimated for completion was reduced to \$970,000, '89, 1942.

In 1892 Col. Craighill estimated the cost of completing the slack-water improvement on the Great Kanawha, by completion of locks and dams 7 and 8, construction of three additional locks and dams, construction of lock houses, and dredging, at \$1,305,700, '92, 2043, 2056.

**Surveys.****MAPS.**

'89, 1951.

**KANAWHA RIVER, LITTLE, W. VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 253.)

**Appropriations.**

1876-'87 .....	\$146, 175
1888 .....	25, 000, '88, 1793.
1890 .....	40, 000, '90, 2278.

Total ..... 211, 175

List of appropriations, '92, 2114.

**Contracts.**

1891. T. W. Moore, for oak timber, at a total of \$6,332, '91, 2472. Pattin, Hall & Pattin, for ironwork, at a total of \$2,118, '91, 2472. G. Kinsey & Co., for ironwork, at a total of \$684.95, '91, 2472.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 228; '89, 266; '90, 240; '91, 308; '92, 295.

**ENGINEER IN CHARGE.**

Maj. D. W. Lockwood, 1888-'—. Reports, '88, 1792; '89, 1987; '90, 2278; '91, 2471; '92, 2114, 2117.

**ASSISTANT.**

B. F. Thomas. Reports, '88, 1793; '89, 1988; '90, 2279; '91, 2472; '92, 2115, 2119.

**Operations.**

1887-'88. 1,090 cubic yards dimension and backing stone quarried and delivered at lock site; 460 cubic yards cut stone and 230 cubic yards backing placed in construction of Lock and Dam No. 5; repairs to chute at Glenville, '88, 1794.

1888-'89. River wall of lock completed; construction of land wall, cofferdam, and lock-keeper's house begun, '89, 1987.

1889-'90. Lock-keeper's house and entire lock masonry completed; lock floor laid; 238 cubic yards stone cut; 2,392 cubic yards masonry laid; 4,116 cubic yards earth excavated; 2,638 linear feet piles driven, and 148 cubic yards concrete laid, '90, 2278.

1890-'91. Framing of lock gates completed; construction of dam begun; 130 cubic yards stone cut; 550 cubic yards laid, and 4,029 cubic yards quarried, '91, 2473.

**KANAWHA RIVER, LITTLE, W. VA.—Continued.****Operations—Continued.**

1891-'92. 16,700 cubic yards material dredged at and below dam site; 250 linear feet crib work sunk and filled in construction of the dam; protection crib, guide crib, and crib work for protection of the river bank built; lock gates, wickets, and maneuvering apparatus put in place; lock floor paved; construction and repair of plant, '92, 2115. Operation and repair of lock and dam, '92, 2118.

**Projects.**

The project of 1876 proposed the construction of a lock and dam near Burning Springs, so as to extend slack-water navigation, for a draft of 4 feet, a distance of 12 miles, and the improvement of the natural channel for an additional distance of 80 miles, by the removal of obstructions, so as to obtain a channel 40 feet wide and at least 2 feet deep during four months of the year; estimated cost of lock and dam, \$62,000, '75, i, 741. In 1878 the dimensions of the lock were increased and the cost estimated at \$84,200, '78, 813; '81, 1989; '82, 1958. In 1883 the estimate was increased to \$135,672.47, '83, 1573. Of the \$129,300 appropriated previous to 1883, \$43,300 was for the removal of obstructions, '83, 1574. Increased cost of work due to the small appropriations, '86, 1623. In 1888 \$51,800 was estimated for completion, '88, 1793.

**KASKASKIA RIVER, ILL.—IMPROVEMENT OF.****Appropriations.**

1890..... \$6,000, '91, 2118.  
1892..... 4,500, '92, 1746.

Total ..... 10,500

**Commerce.**

Flour trade, '88, 1454.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 195; '91, 263; '92, 252.

**ENGINEER IN CHARGE.**

Maj. A. M. Miller, 1886-'—. Reports, '88, 1453; '91, 2118; '92, 1745.

**ASSISTANTS.**

C. D. Lamb. Report, '88, 1456.

R. Klemm. Report, '92, 1746.

**Operations.**

1891-'92. Construction of quarters and preparation of plant; 31,838 cubic feet of stone dike built at Evansville Shoal; rock removal at Kaskaskia and Nine Mile Shoal, '92, 1746.

**Obstructions.**

Bridges crossing the Kaskaskia, '88, 1455.

**Physical Characteristics.**

Description of the river, '88, 1453.

**Projects.**

By Maj. Miller, 1888, for improvement of the Kaskaskia from New Athens to its mouth, giving a low-water depth of 3 feet at a Mississippi stage of 6½ feet, by removal of two rock-and-gravel shoals, at an estimated cost of \$6,000, '88, 1455, 1456. Increased to \$10,000 in 1892, '92, 1746.

**Surveys.**

Survey ordered by act of August 5, 1886. Made, 1888, under direction of Maj. Miller, '88, 1455.

**KENNEBEC RIVER AT BATH, ME., and from Augusta to lower end of Perkins Island.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 37.)

**Appropriations.**

1870-'81 ..... \$206,945.71  
1888..... 75,000.00, '89, 528.  
1890..... 50,000.00, '90, 443.  
1892..... 100,000.00, '92, 514.

Total ..... 431,945.71

List of appropriations, '92, 514.

**KENNEBEC RIVER AT BATH, ME., and from Augusta to lower end of Perkins Island—Continued.****Commerce.**

Importance of the river as a water communication between the seaboard and the interior of the State; lumber, granite, and ice shipments, '88, 415, 416.

Shipping and freight, '89, 529.

**Contracts.**

1889. M. J. Wheeler, for stone, at 99 cents per ton, and fascines, at 85 cents each, '89, 528.

1890. Jordan & Carleton, for removal of old bridge piers, at a total cost of \$2,423.

1892. Moore & Wright, for dredging, at 17½ cents per cubic yard, '92, 515.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 16, 22; '89, 25; '90, 20; '91, 26, 33, 424; '92, 30, 39.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1888-'92. Reports, '88, 412, 417; '89, 527; '90, 442; '91, 590, 622.

Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 513, 544.

**ASSISTANT.**

F. S. Burrowes. Reports, '88, 421; '92, 547.

**Operations.**

1888-'89. 4,542 tons stone and 359 fascines delivered, '89, 528.

1889-'90. 24,735 tons stone and 6,600 fascines placed in the work, '90, 442.

1890-'91. 17,800 tons stone and 4,300 fascines placed in the work; 64,696 cubic yards material dredged; removal of old bridge piers begun, '91, 591, 592, 593.

1891-'92. 30,000 cubic yards sand dredged, '92, 513.

**Plans.**

By Lieut. Col. Hains, 1892, for securing a 5-foot navigation from the steamboat landing at Augusta to Waterville, at a cost of \$45,800; also for lengthening the lock at Augusta, at a cost of \$25,000, making the total estimated cost of the improvement \$70,800, '92, 547.

**Projects.**

By Col. Thom, 1870 and 1878, for the formation of a channel not less than 90 feet wide and from 11 to 12 feet deep at mean low water by the removal of rock, '70, 81; '78, 197; '79, 253; '82, 67. Project completed in 1883 by the expenditure of \$45,500, '83, 62.

By Lieut. Col. Smith, 1888, for improvement of Kennebec River at Bath, and from Augusta to lower end of Perkins Island, by removal of shoals at Beef Rock, Hatchs Rock, and South Gardiner by means of wing dams and training walls; removal of rocks in harbor at Bath and at Lovejoys Narrows by blasting and dredging the shoals from Augusta to Gardiner; estimated cost, \$410,500, '88, 417; '89, 527. Increased in 1892 to \$428,500, '92, 514.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Lieut. Col. Smith, '88, 412, 417.

Survey ordered by act of September 19, 1890. Made, 1892, under direction of Lieut. Col. Hains, '92, 545.

**MAPS.**

'90, 442.

**KENNEBUNK RIVER, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 255.)

**Appropriations.**

1829-'81 ..... \$65, 175  
1890..... 20, 000, '90, 449.

Total ..... 85, 175

List of appropriations, '88, 392.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 19; '89, 28, 32; '90, 23, 26; '91, 29; '92, 35.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1881-'92. Reports, '88, 392; '89, 537; '90, 449, 471; '91, 601.

Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 524.

**KENNEBUNK RIVER, ME.—Continued.****Operations.**

- 1887-'88. Repairs to wooden pier; project completed and no further work contemplated, '88, 392.  
 1888-'90. No operations, '89, 537; '90, 449.  
 1890-'91. Repairs to wharf and piers in progress, '91, 601.  
 1891-'92. Repairs to wharf and protection of base of east jetty; construction of jetty at Wading Place, '92, 525.

**Projects.**

By Col. Thom, 1878, for dredging, rock excavation, and repairs to piers and wharves; estimated cost, \$6,000, '78, 203; '79, 260. Project completed in 1882, '82, 500; '87, 19.

After a survey in 1889, Lieut. Col. Smith estimated \$20,000 as the amount necessary to repair the piers and construct one small jetty, '90, 449, 474.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Smith, '90, 449, 473.

**KENOSHA HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 255.)

**Appropriations.**

1844-'87 .....	\$220, 307. 41
1888 .....	7, 500. 00, '88, 1866.
1890 .....	17, 500. 00, '90, 2361.
1892 .....	15, 000. 00, '92, 2208.

Total ..... 260, 307. 41

List of appropriations, '92, 2208.

**Contracts.**

1888. C. H. Starke, for dredging, at 19 cents per cubic yard, '89, 2081.  
 1889. S. O. Dixon, for dredging, at 17 cents per cubic yard, '90, 2360.  
 1890. H. Cooper and George Truman, for pier extension, at \$9,812, '91, 2567.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 244; '89, 283, 286; '90, 256; '91, 326; '92, 312.

**ENGINEERS IN CHARGE.**

Capt. W. L. Marshall, 1884-'89. Report, '88, 1866.

Maj. C. E. L. B. Davis, 1889-'92. Reports, '89, 2079, 2301; '90, 2360; '91, 2565.

Maj. J. F. Gregory, 1892-'— . Report, '92, 2207.

**Operations.**

1887-'88. 49 piles driven along channel face of inner section of south pier, and 7,272 cubic yards sand dredged from the channel, '88, 1866.

1888-'89. 24,893 cubic yards material dredged, '90, 2360.

1889-'90. 5,248 cubic yards material dredged, '90, 2360.

1890-'91. 20,918 cubic yards material dredged; 3 cribs built in extension of south pier, '91, 2566.

1891-'92. Three cribs sunk, filled, and decked, extending the south pier 150 feet; 8,640 cubic yards material dredged, '92, 2207.

**Plans.**

Maj. Davis, 1888, reports that there exists no present necessity for the formation of a harbor of refuge at Kenosha Harbor, '89, 2105.

**Projects.**

From 1844 to 1879, inclusive, \$194,307.41 had been appropriated for pier extension, dredging, and repairs, '80, 208.

By Maj. Houston, 1879, for completion of Maj. Wheeler's project of 1866 for securing a channel of 12 feet depth and navigable width by pier extension and dredging, \$67,000, '79, 156; '80, 1938.

By Maj. Davis, 1889, for extension of north pier 300 feet and south pier 600 feet, to prevent the formation of a bar at the harbor entrance; estimated cost, \$82,000, '89, 2080. Making the total estimated cost of project for improvement \$149,000, '92, 2208.

**Surveys.**

Examination for harbor of refuge ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Davis, '89, 2103.

**KENT ISLAND NARROWS, MD.**—(See CHESTER RIVER, MD.)**KENTUCKY RIVER, KY.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 256.)

**Appropriations.**

1879-'80 .....	\$1, 141, 495. 74
1888.....	180, 000. 00, '88, 1771.
1890.....	180, 000. 00, '90, 2263.
1892.....	150, 000. 00, '92, 2085.

Total ..... 1, 651, 495. 74

List of appropriations, '92, 2085.

**Contracts.**

1888. Mason, Gooch &amp; Hoge Company, for furnishing lock stone, at \$87,238, '89, 1972.

1889. G. S. Adams, for cement, at \$1.21 per barrel, '89, 1973. Choate &amp; Brawner, for 3 lock houses, at \$2,041 each, '89, 1978.

1890. D. K. Sprinkle, for construction of 2 dump scows, at \$1,750 each, and dredge-boat hull, at \$2,590, '90, 2269.

1891. E. W. Fisher, for Portland cement, at \$2.68 per barrel, '91, 2450. J. B. Speed &amp; Co., for American natural cement, at \$1.01 per barrel, '91, 2450.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 226, 227; '89, 263, 264; '90, 237, 238; '91, 305, 306; '92, 291, 292.

**ENGINEER IN CHARGE.**

Maj. D. W. Lockwood, 1888-'—. Reports, '88, 1769, 1775; '89, 1970, 1975; '90, 2261, 2266; '91, 2449, 2455; '92, 2083, 2091.

**ASSISTANT.**

R. S. Burnett. Reports, '88, 1772, 1777; '89, 1973, 1978; '90, 2264, 2269; '91, 2450, 2457; '92, 2085, 2092.

**Operations.**

1887-'88. Crest, upper steps, portions of guide walls, and floors of passes of Beattyville Dam removed; channel 100 feet wide and 350 feet long cut through high bar below the chutes; 378 linear feet of protection wall built along Proctor Bank below passes; quarry stripped and track laid for stone for Lock No. 7, '88, 1772-1774. Operation and repair of locks and dams, '88, 1775-1786.

1888-'89. Removal of guide walls of Beattyville Dam continued; protection wall along the Proctor Bank raised 3 feet; quarrying stone for Lock No. 7 begun; repair and construction of plant, '89, 1973, 1974. Operation and repair of locks and dams, '89, 1975-1982.

1889-'90. Removal of guide walls, gates, and floors of Beattyville Dam continued; cofferdam built; lower wing of Beattyville abutment strengthened by cribbing; 1,555 cubic yards dimension stone cut, and 215 cubic yards special stone prepared; 336 cubic yards backing quarried, '90, 2264, 2265. Operation and care of locks and dams, '90, 2266.

1890-'91. Dredge built; dredging and excavation for cofferdam; excavation for abutment, and construction and erection of plant for Lock No. 6, '91, 2450. 37,000 cubic yards material dredged, '91, 2453. Construction of Beattyville Dam continued, '91, 2454. Operation and repair of locks and dams, '91, 2455.

1891-'92. Lock and Dam No. 6 completed; Beattyville Dam extended to Proctor side of the river; 2,947 cubic yards rock blasted and removed, and 852 cubic yards of sand dredged, '92, 2083, 2084. Operation and repair of locks and dams, '92, 2091.

**Projects.**

By Maj. Merrill, '1879, for slack-water navigation for a draft of 6 feet on Kentucky River from mouth to Three Forks, a distance of 258 miles, by repairs to old locks and dams, and construction of twelve new locks and dams; estimated cost, \$1,074,402, '79, 1399; '80, 1826.

In 1883, after an aggregate appropriation of \$550,000, Capt. Post revised the estimate and concluded that \$2,471,639.26 was required to complete the project, '83, 1562.

Plan and location of Lock and Dam No. 6, as proposed by Maj. Post, approved by Board of Engineers of 1887, '87, 1880. The Board of Engineers of 1887 considered that the chutes at the Beattyville movable dam do not meet the requirements of navigation, and that the stone lock and dam originally contemplated should be substituted therefor, '87, 1881, 1884.



**KEWAUNEE HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 258.)

**Appropriations.**

1881-'87 .....	\$45,000
1888.....	10,000, '88, 1849.
1890.....	20,000, '90, 2341.
1892.....	30,000, '92, 2188.

Total ..... 105,000

List of appropriations, '92, 2187.

**Contracts.**

1888. Knapp &amp; Gillen, for construction of 300 linear feet of pile pier, at a total of \$7,968, '89, 2057.

1890. J. M. Borgman, for pier extension, at a total of \$9,239, '91, 2542.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 239; '89, 278; '90, 251; '91, 322; '92, 308.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1848; '89, 2055; '90, 2340; '91, 2540.

Maj. J. F. Gregory, 1892-'— Report, '92, 2187.

**Operations.**

1887-'88. North pile pier extended 200 feet under contract, '88, 1848.

1888-'89. 7,280 cubic yards dredged from channel between the piers by hired labor; 100 linear feet of south pile pier completed under contract, '89, 2056.

1889-'90. 200 linear feet of south pile pier built under contract; 15 cords stone deposited in breach protection by hired labor, '90, 2340.

1890-'91. 77,790 cubic yards material dredged; construction of pile-pier work begun, '91, 2541.

1891-'92. North pier extended 250 feet and south pier 50 feet, '92, 2187.

**Private and Corporate Work.**

Total appropriations by local authorities in aid of improvement, '89, 2056.

5,231 cubic yards material dredged from inner harbor by city of Kewaunee and private parties, '89, 2056.

**Projects.**

By Maj. Robert, 1881, for construction of two parallel pile and crib piers, 1,650 feet long each and 200 feet apart, extending from the shore line to the 18-foot curve, and located at the point where the Kewaunee River first approaches the lake and turns to the north; also dredging in the channel between the piers and interior basin; estimated cost, \$200,000, '81, 2083, 2084; '91, 2541; '92, 2187.

**Surveys.****MAPS.**

'88, 1848.

**KEYPORT HARBOR, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 259.)

**Appropriations.**

1882.....	\$30,475
1892.....	5,000, '92, 890.

Total ..... 35,475

**Commerce.**

Increase in commerce consequent upon improvement, '88, 662.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 73; '89, 93; '90, 83; '91, 104; '92, 106.

**ENGINEERS IN CHARGE.**

Capt. G. McC. Derby, 1886-'89. Report, '88, 662.

Capt. T. L. Casey, 1889-'—. Reports, '89, 839; '90, 863; '91, 1001; '92, 889.

**Operations.**

1887-'90. No operations, '88, 662; '89, 840; '90, 863; '91, 1002; '92, 889.

**Physical Characteristics.**

Description of the harbor, '88, 662.

**Projects.**

By Lient. Col. Newton, 1873, for improvement of harbor by excavation of a channel 4,700 feet in length, 200 feet in width, and having a mean low-water depth of 8 feet; estimated cost, \$30,475, '73, 942. Revised as to cost in 1884 to \$40,475, '84, 759; '87, 776; '91, 1002.

**KEY WEST HARBOR, NORTHWEST ENTRANCE, FLA.—  
IMPROVEMENT OF.**

(Continued from Vol. II, p. 259.)

**Appropriations.**

1882-'87 .....	\$27,500
1888.....	25,000, '88, 1093.
1890.....	40,000, '90, 1580.
1892.....	75,000, '92, 1376.

Total ..... 167,500

**Commerce.**

Advantages that would follow the deepening of Northwest Bar, '89, 1336.

**Contracts.**

R. G. Ross, for stone, at \$1.90 per cubic yard, '91, 1641.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 146; '89, 168, 1328; '90, 150, 1582; '91, 188; '92, 186.

**BOARD OF ENGINEERS.**

Convened at St. Augustine, January 31, 1889, to examine and report upon Capt. Black's plan for improvement of Key West Harbor. Report, '89, 1329; '90, 1581, 1583. (Col. Abbot, Lieut. Col. Hains, and Capt. Bixby.)

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1886-'92. Reports, '88, 1092; '89, 1324, 1333; '90, 1578; '91, 1640.

Maj. J. C. Mallery, 1892-'— . Report, '92, 1374.

**ASSISTANT.**

J. W. Sackett. Reports, '89, 1326, 1333; '90, 1594.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1092.

1888-'90. No operations, '89, 1325; '90, 1580.

1890-'91. 1,160 cubic yards stone deposited in jetty, '91, 1641.

1891-'92. 26,822 cubic yards stone deposited in the jetty, '92, 1375.

**Physical Characteristics.**

Description of Florida Keys, '88, 1092; '89, 1324.

Current observations, '89, 1333; '90, 1594.

**Projects.**

By Capt. Damrell, 1882, for improvement of Northwest Channel by excavation of a cut 300 feet wide at top and 17 feet deep at mean low water; estimated cost, \$140,000, '82, 1314. Channel 60 feet wide and 15 feet deep formed in 1883-'84, '84, 1167; '87, 1221.

By Capt. Black, 1887, for the formation and maintenance of a channel across the bar, 17 feet deep at mean low water, by means of a dike along its western side, with rock removal and dredging; estimated cost, \$608,000, '88, 1093.

By Board of Engineers, 1890, for construction of a stone jetty along the submerged reef on the northeast side of the Northwest Passage near its northerly end, the jetty to be raised approximately to the level of mean low water; estimated cost, \$500,000, '90, 1587; '92, 1375.

**Surveys.****MAPS.**

'92, Atlas, 66, 67.

**KINGSTON HARBOR, MASS.—SURVEY OF.****Appropriations.**

1892..... \$10,000

**Commerce.**

Commercial interests involved, '91, 686.

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 47.

**ENGINEER IN CHARGE.**

Lieut. Col. S. M. Mansfield, 1891. Report, '91, 686.

**ASSISTANT.**

T. T. Hunter Harwood. Report, '91, 688.

**Physical Characteristics.**

Description of the locality, '91, 685.

**KINGSTON HARBOR, MASS.—Continued.****Plans.**

By Lieut. Col. Mansfield, 1891, for excavation of a channel 6 feet deep at mean low water and 100 feet wide up to the Cordage Company's Wharf in North Plymouth; estimated cost, \$10,000, '91, 687.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Mansfield, '91, 687.

**MAPS.**

'91, 688.

**KLAMATH RIVER, CAL.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 352.

**ENGINEER IN CHARGE.**

Maj. W. H. Heuer, 1888. Report, '89, 2495.

**Physical Characteristics.**

Description of the locality, '89, 2495.

**Plans.**

In 1888 Maj. Heuer considered that the commerce to be benefited was not commensurate with the cost of the improvement, '89, 2495.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Heuer, '89, 2495.

**LAKE CHAMPLAIN, VT.—(See GORDONS LANDING, BREAKWATER.)****LAKE CHAMPLAIN.—IMPROVEMENT OF CHANNEL BETWEEN NORTH AND SOUTH HERO ISLANDS.**

(Continued from Vol. II, p. 262.)

**Appropriations.**

1836.....	\$31,000
1888.....	10,000, '89, 2445.
Total .....	41,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 287; '89, 340; '90, 307.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1887— Reports, '89, 2444; '90, 2876.

**Operations.**

1887-'89. No operations, '88, 287; '89, 2444.

1889-'90. 17,326 cubic yards material dredged, '90, 2877.

**Projects.**

By Maj. Gillespie, to widen the existing channel to 250 feet by dredging; estimated cost, \$8,000, '82, 718, 719.

By Maj. Adams, 1886, for the formation of a dredged channel 150 feet wide and 10 feet deep; estimated-cost, \$14,300, '87, 2413.

**LAKE CHAMPLAIN, N. Y. AND VT.—IMPROVEMENT OF NARROWS.**

(Continued from Vol. II, p. 261.)

**Appropriations.**

1886.....	\$30,000
1888.....	15,000, '88, 2103.
1892.....	18,500, '92, 2615.
Total .....	63,500

**LAKE CHAMPLAIN, N. Y. AND VT.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 289; '89, 343; '90, 309; '91, 387; '92, 365.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1887-'— Reports, '88, 2102; '89, 2452; '90, 2883; '91, 2937; '92, 2614.

**Operations.**

1887-'88. Dredging under contract continued, '88, 2102.

1888-'89. Dredging continued, '89, 2453.

1889-'90. Dredging continued, '90, 2883.

1890-'92. No operations, '91, 2937; '92, 2615.

**Projects.**

By Lient. Col. Robert, 1885, for the formation of a channel 150 feet wide and 12 feet deep from the Elbow to Whitehall by dredging and rock removal, at an estimated cost of \$30,000, '85, 2312, 2313. Also the formation, by dredging, of a channel 200 feet wide and 12 feet deep from Four Channels to Bensons Landing, at an estimated cost of \$50,000, '85, 2315, 2318; '91, 2937; '92, 2614.

**LAKE GEORGE, N. Y.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 343.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1888. Report, '89, 2454.

**Plans.**

In 1888 Maj. Adams did not consider the locality worthy of improvement by the General Government, '89, 2455.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Adams, '89, 2454.

**LAKE PEPIN, MISSISSIPPI RIVER.—HARBOR OF REFUGE IN.**

(Continued from Vol. II, p. 263.)

**Appropriations.**

1882-'87 ..... \$60,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 199, 200; '89, 234; '90, 209.

**ENGINEER IN CHARGE.**

Maj. A. Mackenzie, 1881-'— Reports, '88, 1529, 1532; '89, 1777; '90, 2072.

**ASSISTANT.**

W. A. Thompson. Report, '88, 1535.

**Operations.**

1887-'88. 512 linear feet crib work sunk in extension of breakwater, '88, 1531.

1888-'89. Repairs and reconstruction of breakwater, '89, 1777.

1889-'90. Riprap placed at crib foundations, '90, 2074.

**Projects.**

By Maj. Mackenzie, 1882, for the formation of harbors of refuge at Lake City, Minn., and Stockholm, Wis., by the extension from the shore of a breakwater at each locality 1,000 feet long; estimated cost, \$228,000, '82, 1796; '83, 237.

**Surveys.****MAPS.**

'90, 2074.

**LAKE PONTCHARTRAIN, LA.—EXAMINATION OF SHOALS AT MIDDLE GROUND.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 221, 1839.

**ENGINEER IN CHARGE.**

Capt. W. L. Fisk, 1890. Report, '91, 1839.

**LAKE PONTCHARTRAIN, LA.—Continued.****Plans.**

In 1890 Capt. Fisk did not consider the locality worthy of improvement, '91, 1839.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Fisk, '91, 1839.

**LARCHMONT HARBOR, N. Y.—IMPROVEMENT OF.****Appropriations.**

1890..... \$5,000, '91, 801.

**Contracts.**

1890. J. A. Bouker, for delivering and placing riprap gneiss, at \$1.07 per ton, '91, 801.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 71; '90, 63; '91, 74; '92, 78.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1888'— Reports, '90, 675; '91, 800; '92, 704.

**ASSISTANTS.**

Lieut. J. C. Sandford. Report, '90, 676.

H. N. Babcock. Report, '90, 678.

**Operations.**

1890-'91. 4,119 tons of riprap delivered, completing 74 linear feet of Umbrella breakwater, and 64 linear feet of Huron breakwater, '91, 801.

1891-'92. No operations, '92, 705.

**Physical Characteristics.**

Description of the locality, '90, 676; '91, 800.

**Plans.**

By Col. Houston, 1889, for improvement of the anchorage area of the harbor by removal of Umbrella and Huron rocks to 15 feet mean low water; estimated cost, \$126,600, '90, 678.

**Projects.**

By Col. Houston, 1890, for improvement of the harbor entrance by construction of two riprap breakwaters extending from Umbrella and Huron rocks to the nearest shore; estimated cost, \$105,000, '91, 800; '92, 705.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Col. Houston, '90, 677.

**LA TRAPPE RIVER, MD.—EXAMINATION OF.****Appropriations.**

1892..... \$2,500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 112; '91, 132.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1888. Reports, '89, 920; '91, 1215.

**ASSISTANT.**

A. Stierle. Reports, '89, 920; '91, 1215, 1217.

**Physical Characteristics.**

Description of the locality, '89, 921; '91, 1215.

**Plans.**

In 1889 Mr. W. F. Smith estimated the cost of dredging the desired channel at \$13,000, '89, 921.

By Mr. W. F. Smith, 1891, for improvement of the river by excavation of a channel 11 feet deep at mean low water and 150 feet wide across the bar at the mouth, and enlargement of the present low-water channel of the river to 75 feet width and 8 feet depth from the mouth to Trappe Landing; estimated cost, \$7,250, '91, 1217.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Mr. W. F. Smith, '89, 920. Survey made, 1891, under direction of Mr. W. F. Smith, '91, 1216.

**LEAF RIVER, MISS.—IMPROVEMENT OF.****Appropriations.**

1860.....	\$5,000, '91, 1793.
1892.....	5,000, '92, 1458.

Total .....	10,000
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**Commerce.**

Commerce to be affected by improvement, '89, 1463.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 1462; '91, 218; '92, 211.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1888-'—. Reports, '89, 1462; '91, 1792; '92, 1458.

**Operations.**

1891-'92. 1,505 snags, stumps, and logs removed from the channel, and 2,156 overhanging trees cleared from the banks, '92, 1458.

**Projects.**

By Maj. Damrell, 1889, for improvement of the river from its mouth to the mouth of Bowie Creek by removal of snags, logs, overhanging trees, and similar obstructions, giving a high-water navigation for five months of the year, at an estimated cost of \$25,000, '89, 1462; '92, 1458.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Damrell, '89, 1462.

**LEWIS AND CLARKE RIVER, OREG.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 421.

**ENGINEER IN CHARGE.**

Maj. T. H. Handbury, 1890. Report, '91, 3383, 3384.

**Physical Characteristics.**

Description of the locality, '91, 3383.

**Plans.**

By Maj. Handbury, 1891, for removal of sand bars, snags, and logs, at an estimated cost of \$1,200, '91, 3385.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Handbury, '91, 3385.

**LEWES, DEL.—CONSTRUCTION OF PIER NEAR.**

(Continued from Vol. II, p. 268.)

**Appropriations.**

1870-'89 .....	\$368,500
1890.....	10,000, '90, 889.

Total .....	378,500
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 81; '89, 99; '90, 89.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1888-'90. Reports, '88, 705; '89, 869.

Maj. C. W. Raymond, 1890-'—. Report, '90, 888.

**Operations.**

1887-'89. No operations; last appropriation made in 1882, '88, 705; '89, 869.  
1889-'90. Minor repairs made to pier, '90, 888.

**Projects.**

By Lieut. Col. Robert, 1889, for repairing a 100-foot breach in the pier; estimated cost, \$10,000, '90, 888.

**LEXINGTON HARBOR, MICH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 319.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1888. Report, '89, 2281.

**Plans.**

In 1888 Col. Poe did not consider the harbor worthy of improvement, '89, 2282.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2281.

**LEXINGTON, MO.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****LICKING RIVER, KY.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 267.)

**Appropriations.**

1888..... \$3,000, '89, 1983.

1890..... 3,000, '90, 2273.

Total ..... 6,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 227; '89, 264; '90, 238; '91, 306; '92, 292.

ENGINEER IN CHARGE.

Maj. D. W. Lockwood, 1889-'— Reports, '89, 1983; '90, 2273; '91, 2462; '92, 2097.

ASSISTANT.

B. F. Thomas. Reports, '90, 2274; '91, 2462.

**Operations.**

1887-'88. No operations, '88, 227.

1888-'89. 133 snags removed from channel and 25 trees from the banks, '89, 1983.

1889-'90. 236 trees, 430 snags, 324 stumps, 4,679 cubic yards solid rock, and 4,172 cubic yards loose rock removed, '90, 2273.

1890-'91. 5,875 cubic yards solid and 2,145 cubic yards loose rock and 80 snags removed from the channel, '91, 2462.

1891-'92. 911 snags, trees, and stumps, 798 cubic yards loose rock, and 2,001 cubic yards solid rock removed, '92, 2097.

**Projects.**

By Maj. Post, 1887, for an improvement extending from Farmers to West Liberty by removal of snags and similar obstructions; estimated cost, \$17,680, '87, 1903.

**LINCHESTER RIVER, MD.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 131, 1202.

ENGINEER IN CHARGE.

Mr. W. F. Smith, U. S. agent, 1891. Report, '91, 1203.

ASSISTANT.

A. Stierle. Report, '91, 1203.

**Physical Characteristics.**

Description of the locality, '91, 1203.

**Plans.**

In 1891 Mr. W. F. Smith did not consider the locality worthy of improvement, '91, 1203.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Mr. W. F. Smith, '91, 1203.

**LINK RIVER, OREG.—EXAMINATION OF.**

(Continued from Vol. II, p. 269.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 304.

ENGINEER IN CHARGE.

Capt. C. F. Powell, 1887. Report, '88, 2179.

**Physical Characteristics.**

Description of the locality, '88, 2179.

**Plans.**

In 1887 Capt. Powell reported the river as unworthy of improvement, '88, 2179.

**Surveys.**

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Powell, '88, 2179.

**LITTLE EGG HARBOR BAY AND INLET, including Great Bay, N. J.—EXAMINATION FOR HARBOR OF REFUGE.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 118.

ENGINEER IN CHARGE.

Maj. C. W. Raymond, 1890. Report, '91, 1095.

**Physical Characteristics.**

Description of the locality, '91, 1095.

**Plans.**

In 1890 Maj. Raymond did not consider the locality worthy of improvement as a harbor of refuge, '91, 1095.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Raymond, '91, 1095.

**LITTLE HARBOR AT PORTSMOUTH, N. H.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 269.)

**Appropriations.**

1886-'87.....	\$10,000
1888.....	20,000, '88, 398.
1890.....	40,000, '90, 454.
1892.....	30,000, '92, 532.

Total ..... 100,000

**Commerce.**

List of vessels wrecked near Little Harbor between 1879 and 1889, '89, 545.

**Contracts.**

1888. New England Dredging Company, for dredging, at 28 cents per cubic yard, '89, 545.

1890. T. A. Rowe, for stone delivered in breakwater, at 69 cents per ton, and for construction of beacon, at \$450, '91, 609.

1892. G. W. Andrews, for breakwater construction stone, at \$1.11 per ton, '92, 533.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 21; '89, 30; '90, 25; '91, 31; '92, 38.

ENGINEERS IN CHARGE.

Lieut. Col. J. A. Smith, 1886-'92. Reports, '88, 397; '89, 543; '90, 454; '91, 608.

Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 531.

**Operations.**

1887-'88. 36,021 cubic yards material dredged from out, '88, 398.

1888-'89. 37,479 cubic yards material dredged, '89, 544.

1889-'90. 27,000 cubic yards material dredged, '90, 454.

1890-'91. Beacon built, and 4,543 tons of stone placed in the breakwater, '91, 609.

1891-'92. 13,502 tons stone placed in the breakwater, '92, 532.



**LITTLE HARBOR AT PORTSMOUTH, N. H.—Continued.****Projects.**

By Col. Thom, 1882, for dredging a channel of entrance to the inner harbor 9 feet deep at mean low water and 100 feet wide, widening the anchorage basin to 300 feet for a distance of 700 feet, and giving additional protection by a small breakwater on the ledge at Jerry Point; estimated cost, \$33,000, '82, 507; '85, 481; '86, 60; '87, 468.

Project enlarged by Lieut. Col. Smith in 1888, to provide for two small breakwaters at the mouth of the harbor, and for dredging the channel and anchorage basin to a depth of 12 feet at low water; estimated cost, \$235,000, '88, 397; '89, 30, 543, 544; '92, 531.

**LITTLE PIGEON RIVER, TENN.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 285, 2287.

ENGINEER IN CHARGE.

Lieut. Col. J. W. Barlow, 1891. Report, '91, 2287.

**Physical Characteristics.**

Description of the locality, '91, 2287.

**Plans.**

In 1891 Lieut. Col. Barlow did not consider the locality worthy of improvement, '91, 2288.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Barlow, '91, 2288.

**LITTLE RIVER, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 271.)

**Appropriations.**

1888..... \$2, 500, '89, 1601.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 179; '89, 210; '90, 189.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1887-'— Reports, '89, 1600; '90, 1881.

**Operations.**

1887-'89, 2,645 logs and snags removed from the channel, and 4,300 trees and stumps removed from the banks, '89, 1601.

1889-'90, 120 snags removed from the channel and 515 trees from the banks, completing the projected improvement, '90, 1881, 1882.

**Projects.**

By Capt. Willard, 1887, for clearing the river of obstructions from Catahoula Lake to Trinity, a distance of about 25 miles; estimated cost, \$2,500, '87, 1499; '89, 1600. Completed in 1890, '90, 1881.

**LITTLE RIVER, MO., from Homersville to its junction with the Saint Francis.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 272.)

**Appropriations.**

1888..... \$5, 000, '88, 191.

1890..... 3, 000, '90, 1957.

Total ..... 8, 000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 191; '89, 225; '90, 202; '91, 256; '92, 247.

ENGINEER IN CHARGE.

Capt. H. S. Taber, 1887-'— Reports, '89, 1668; '90, 1956; '91, 2064; '92, 1696.

**LITTLE RIVER, MO., from Homersville to its junction with the Saint Francis—Continued.****Operations.**

1887-'89. No operations, '88, 191; '89, 1669.

1889-'90. Snagging operations begun, '90, 1956.

1890-'91. 109 snags removed from the channel, 25 cubic yards of earth excavated, 161 trees cleared from the banks, and a dam 300 feet long built across chute, '91, 2064.

1891-'92. 96 snags and 8 drift piles removed from the channel, and 1,087 overhanging trees cleared from the banks, '92, 1697.

**Projects.**

By Capt. Taber, 1887, for an eight-months navigation from the mouth to Homersville by dam construction closing cut-off, and removal of snags and similar obstructions, at an estimated cost of \$8,000, '87, 1549; '88, 191. Increased in 1892 to \$11,000, '92, 1697.

**LITTLE SALEM CREEK, N. J.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 102.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert, 1888. Report, '89, 876.

ASSISTANT.

L. Y. Schermerhorn. Report, '89, 877.

**Physical Characteristics.**

Description of the locality, '89, 877.

**Plans.**

In 1888 Lieut. Col. Robert did not consider the creek worthy of improvement, '89, 877.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Robert, '89, 877.

**LITTLE SODUS HARBOR, N. Y.—(See SODUS HARBOR (LITTLE), N. Y.)****LITTLE TENNESSEE RIVER, TENN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 272.)

**Appropriations.**

1882..... \$5,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 209.

ENGINEER IN CHARGE.

Lieut. Col. J. W. Barlow, 1886-'—. Report, '88, 1604.

**Operations.**

1887-'88. No operations, '88, 1604.

**Physical Characteristics.**

Description of stream, '88, 1604.

**Projects.**

By Maj. King, 1882, for improvement from its mouth to the mouth of the Tellico River, about 13 miles, by removal of snags, logs, bowlders, and similar obstructions, and construction of stone wing dams, securing a channel 40 feet wide and 2 feet deep; estimated cost, \$23,724, '82, 1868, 1869.

**LOCKWOODS FOLLY RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 273.)

**Appropriations.**

1890.....	\$5,000, '91, 1403.
1892.....	3,000, '92, 1179.

Total .....	8,000
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**Contracts.**

1891. Atlas Dredging Company, for dredging, at 20 cents per cubic yard, '91, 1404.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 167; '92, 167.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1887-'92. Report, '91, 1402.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1177.

**ASSISTANT.**

E. D. Thompson. Report, '92, 1179.

**Operations.**

1891-'92. 20,777 cubic yards material dredged, '92, 1178.

**Physical Characteristics.**

Description of the locality, '92, 1177.

**Projects.**

By Capt. Bixby, 1887, for the excavation of a 6-foot low-water channel 100 feet wide from the mouth to the head of navigation at Lockwoods Folly Bridge, a distance of 25 miles; estimated cost, \$40,000, '87, 1101; '91, 1402.

**Surveys.****MAPS.**

'92, Atlas, 37, 38.

**LOUISA FORK OF SANDY RIVER, VA.—(See BIG SANDY RIVER.)****LUBEC CHANNEL, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 274.)

**Appropriations.**

1879-'87 .....	\$105,000
1888.....	20,000, '88, 375.

Total .....	125,000
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List of appropriations, '88, 375.

**Commerce.**

Benefits to, from improvement, '88, 374.

**Contracts.**

1889. A. R. Wright, for dredging, at 35 cents per cubic yard, '89, 505.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 11; '89, 19; '90, 15; '91, 19, 33, 424; '92, 24.

**ENGINEERS IN CHARGE.**

Lient. Col. J. A. Smith, 1886-'92. Reports, '88, 374; '89, 504; '90, 428; '91, 571, 616, 621.

Lient. Col. P. C. Hains, 1892-'—. Report, '92, 495.

**Operations.**

1887-'88. 24,172 cubic yards material dredged, '88, 374.

1888-'89. No operations, '89, 504.

1889-'90. 20,286 cubic yards material dredged, '90, 428.

1890-'91. 29,172 cubic yards material dredged, '91, 571.

1891-'92. No operations, '92, 496.

**Physical Characteristics.**

Relation of channel to surrounding points, '88, 374.

**Plans.**

By Lient. Col. Smith, 1891, for widening the existing channel to 650 feet at mean low water; estimated cost, \$231,000, '91, 618.

**LUBEC CHANNEL, ME.—Continued.****Projects.**

By Lieut. Col. Thom, 1879, for improvement of bars between the Narrows and Western Bar Beacon, a distance of 2½ miles, by widening the channel to 200 feet and deepening to 12 feet; estimated cost, \$48,000, '79, 44, 246, 280, 282.

Revised in 1880 to \$130,000, '80, 326. Amended in 1881 and 1882 to \$154,000, '81, 460; '82, 487.

From 1879 to 1882, inclusive, \$129,000 was appropriated.

In 1883 Col. Blunt proposed increasing the width of the channel to 275 feet and depth to 15 feet, at an estimated cost of \$113,000, '83, 409; '85, 463.

In 1884 the aggregate of appropriations was \$139,000, when the estimate to complete was amended to \$167,500, '86, 529.

Amount estimated for completion in 1888, \$2,500, '88, 375.

Project completed in 1891 at a cost of \$168,929, '92, 496.

**Surveys.**

Examination of the channel. Made, 1890, under direction of Lieut. Col. Smith, '91, 617.

**LUDINGTON HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 275.)

**Appropriations.**

1867-'87 .....	\$292, 435
1888 .....	60, 000, '88, 1906.
1892 .....	5, 000, '92, 2327.

Total ..... 357, 435

List of appropriations, '92, 2327.

**Contracts.**

1889. Truman & Cooper, for pier construction, at a total of \$52,417.97, '89, 2175.

Truman & Cooper, for pile-pier construction, at a total of \$55,568.16.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 253; '89, 296; '90, 267, 2625; '91, 338; '92, 324.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1905.

Maj. W. Ludlow, 1889-'— . Reports, '89, 2173; '90, 2621, 2628; '91, 2682; '92, 2326.

**Operations.**

1887-'88. 3,780 cubic yards material dredged from the channel, '88, 1906.

1888-'89. 4 cribs for the north pier begun, '89, 2174.

1889-'90. 500 linear feet of crib work added to north pier; 17,018 cubic yards sand dredged; 400 linear feet of crib work added to north pier; 592 linear feet of sand fence built upon south beach, '90, 2621.

1890-'91. Repairs to north pier, '91, 2683.

1891-'92. 19,397 cubic yards sand dredged by hired labor, '92, 2326.

**Projects.**

By Maj. Wheeler, 1866, for 2 parallel crib piers 200 feet apart, extending into the lake 450 feet on the north side and 640 feet on the south side; repairs to old north slab pier; removal of old south slab pier; close piling in south side of crib and dredging to 12 feet, '67, 25, 114. Estimated cost amended in 1879, \$213,787, '80, 2014; '85, 2074. Whole amount appropriated from 1867 to 1884, inclusive, \$263,185, '85, 2074.

By Capt. Lockwood, 1884, for formation of harbor of refuge by widening to 400 feet the present entrance to Pere Marquette Lake by construction of a new south pier and dredging channel to 18 feet; estimated cost, \$419,185, '84, 2001; '85, 2093. Recommended by Board of Engineers, 1884, '85, 2093.

In 1880 the project was amended by Maj. Ludlow, with the approval of the Chief of Engineers, to retain the south pier in its position as indicated in the project of 1866, '90, 2622.

**Surveys.****MAPS.**

'90, 2630.

**LUMBER RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 276.)

**Appropriations.**

1888.....	\$5,000, '88, 128.
1890.....	5,000, '90, 1199.
1892.....	5,000, '92, 1200.

Total ..... 15,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 128; '89, 150; '90, 138; '91, 171; '92, 170.

**ENGINEER IN CHARGE.**

Capt. F. V. Abbot, 1888-'—. Reports, '89, 1158, 2795; '90, 1198; '91, 1445; '92, 1199.

**ASSISTANT.**

R. Whitford. Reports, '89, 1159; '90, 1199; '91, 1447; '92, 1200.

**Obstructions.**

Bridges of Carolina Central R. R., W. and C. R. R., and low bridge at Nicholas, '89, 2795.

**Operations.**

1887-'90. No operations, '88, 128; '89, 1159; '90, 1199.

1890-'91. 2,434 snags and logs cleared from the channel, and 3,472 trees cut from the banks, '91, 1447.

1891-'92. River cleared of snags and similar obstructions from the mouth to 50 miles above, '92, 1199.

**Projects.**

By Capt. Bixby, 1887, for clearing the river of obstructions so as to permit of a 4 to 6 foot draft steam navigation from its mouth to Lumberton; estimated cost, \$35,000, '87, 1106; '92, 1199.

**Surveys.****MAPS.**

'90, 1198.

**LYNN HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 277.)

**Appropriations.**

1882-'87.....	\$66,000
1888.....	10,000, '88, 446.
1890.....	15,000, '90, 498.
1892.....	10,000, '92, 573.

Total ..... 101,000

**Contracts.**

1888. Bay State Dredging Company, for dredging, at 29 cents per cubic yard in main ship channel, and 45 cents per cubic yard in Saugus River Channel; also for removal of bowlders over 3 tons each, at \$10 per cubic yard, '89, 570.

1890. New England Dredging Company, for dredging, at 18 cents per cubic yard, '91, 643.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 26; '89, 37; '90, 31; '91, 39; '92, 45.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 445.

Lieut. Col. S. M. Mansfield, 1889-'—. Reports, '89, 568; '90, 494; '91, 641; '92, 572.

**Operations.**

1887-'89. No operations, '88, 446; '89, 569.

1889-'90. 25,571 cubic yards material dredged, '90, 495.

1890-'91. No operations, '91, 642.

1891-'92. 40,000 cubic yards material dredged from the harbor basin, '92, 573.

**Projects.**

By Board of Engineers, 1884, for the formation of a channel 200 feet wide and 10 feet deep at mean low water, from a point near the White Rocks to deep water opposite Little Nahant, and from deep water opposite Sand Point to Lynn Harbor line; the upper part of the channel to be maintained by occasional dredging, the lower part by a training wall joining the land at Little Nahant; estimated cost, \$145,000, '84, 521, 528. Cost revised to \$157,000, '85, 517; '87, 509.

**LYNN HARBOR, MASS.—Continued.****Projects—Continued.**

In September, 1888, the project was modified by extending the inner channel 400 feet inside the harbor line and making at its inner end an anchorage basin 500 by 300 feet and 10 feet deep at mean low water; revised cost of project, \$182,000, '89, 37; '92, 573.

**Surveys.**

Of the improved channels made, 1888, under direction of Lieut. Col. Gillespie, '88, 446.

**LYNN HAVEN BAY, VA.—SURVEY FOR HARBOR OF REFUGE.**

(Continued from Vol. II, p. 277.)

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 146; '92, 147.

**ENGINEER IN CHARGE.**

Lieut. Col. P. C. Hains, 1892. Report, '92, 1076.

**Physical Characteristics.**

Description of the locality, '92, 1077.

**Plans.**

By Lieut. Col. Hains, 1891, for the formation of a harbor of refuge in Lynn Haven Bay near Cape Henry at the foot of Chesapeake Bay, Va., by construction of a breakwater 4,500 feet long, of concrete blocks laid close and bonded together; estimated cost, \$1,555,538, '92, 1079.

**Surveys.**

Survey for harbor of refuge ordered by act of March 3, 1891. Made, 1891, under direction of Lieut. Col. Hains, '92, 1076.

**LYNN HAVEN BAY, Waterway connecting, with Eastern Branch of Elizabeth River, Va.—EXAMINATION FOR.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 153, 1310.

**ENGINEERS IN CHARGE.**

Capt. C. B. Phillips, 1880. Report, '91, 1312.

Lieut. G. J. Fiebeger, 1890. Report, '91, 1310.

**ASSISTANT.**

F. W. Frost. Report, '91, 1313.

**Physical Characteristics.**

Description of the locality, '91, 1313.

**Plans.**

In 1890 Lieut. Fiebeger did not consider the locality worthy of improvement, '91, 1312.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Fiebeger, '91, 1310.

**MACHODOC RIVER, VA.—EXAMINATION OF.**

(Continued from Vol. II, p. 277.)

**Appropriations.**

1892..... \$3,000

**Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 135.

**ENGINEER IN CHARGE.**

Col. Wm. P. Craighill, 1889. Report, '89, 1037.

**MACHODOC RIVER, VA.—Continued.****Physical Characteristics.**

Description of the locality, '89, 1037.

**Plans.**

In 1888 Col. Craighill did not recommend the improvement of the locality, '89, 1037.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Mr. S. T. Abert, '89, 1037.

**MACKEYS CREEK, N. C.—IMPROVEMENT OF.****Appropriations.**

1890..... \$15,000, '91, 1340.

**Commerce.**

Commercial interests, '89, 1138.

**Contracts.**

1891. Alabama Dredging and Jetty Company, for dredging, at 26 cents per cubic yard, '91, 1340.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 149; '91, 155; '92, 156.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1888-'92. Reports, '89, 1137; '91, 1339.

Maj. W. S. Stanton, 1892-'— Report, '92, 1113.

**Operations.**

1890-'91. Dredging in progress under contract, '91, 1339.

1891-'92. 41,359 cubic yards of material dredged, '92, 1114.

**Physical Characteristics.**

Description of the locality, '89, 1137.

**Projects.**

By Capt. Bixby, 1889, for improvement of the creek entrance by the excavation of a straight channel of 100 feet width and 9 feet depth at low water from the mouth of the creek across the bar to Albemarle Sound; estimated cost, \$15,000, '89, 1139; '91, 1339.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1137.

**MAPS.**

'91, 1340.

**MAHON RIVER, DEL.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 112.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1889. Report, '89, 908.

**ASSISTANT.**

A. Stierle. Report, '89, 909.

**Physical Characteristics.**

Description of the locality, '89, 909.

**Plans.**

In 1889 Col. Craighill did not consider the locality worthy of improvement, '89, 909.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of W. F. Smith, '89, 908.

**MALDEN AND MYSTIC RIVERS, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 278.)

**Appropriations.**

1882..... \$10,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 29; '89, 43.

**MALDEN AND MYSTIC RIVERS, MASS.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1886-'— Report, '88, 456.

Lieut. Col. S. M. Mansfield, 1888-'— Report, '89, 594.

**Operations.**

1887-'88. No operations; channel improvements completed, '88, 456.

**Projects.**

The project originally proposed by Lieut. Thom, in 1880, was to excavate a channel 100 feet wide and 12 feet deep at mean high water up to the second bridge in Malden, with 2 cut-offs, one east of the island near the mouth of the river, and one through the marsh, one-half mile above; estimated cost, \$40,000. This project was modified in 1882, when it was proposed to make the natural channel of the river 100 feet wide, 12 feet deep at mean high water to the first bridge in Malden, thence to the second bridge 75 feet wide with the same depth, at an estimated cost of \$47,000.

Lieut. Col. Gillespie states, in 1888, that the improved channel meets all existing requirements, and further appropriations are therefore not recommended, '88, 456.

**Plans.**

In 1888, after examination, Lieut. Col. Gillespie did not consider that the cost of straightening and deepening the existing channel to admit of 12 feet at high-water range of tides, estimated at \$37,000, was commensurate with the commercial interests to be subserved, '89, 594.

**Surveys.**

Examination for straightening and deepening the channel ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Gillespie, '89, 594.

**MAMARONECK HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 279.)

**Appropriations.**

1882..... \$15,000

List of appropriations, '88, 569.

**Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 53.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886-'— Report, '88, 569.

**Operations.**

1887-'88. Available funds not sufficient to continue work under project, '88, 569.

**Physical Characteristics.**

Description of the harbor, '88, 569.

**Projects.**

By Maj. Barlow, 1882, for improvement of Mamaroneck Harbor by removal of Round Rock and part of Nells Rock to 4-foot depth, and of Bush Rock, Inner and Outer Steamboat rocks, and Little Nanhook to 7-foot depth, together with the excavation of a 7-foot channel 100 feet wide to the old steamboat wharf and continuing it with 4-foot depth and 80-foot width to new steamboat wharf; estimated cost, \$43,000, '82, 639, 640; '87, 623; '88, 569.

**MANASQUAN RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 279.)

**Appropriations.**

1879-'82..... \$39,000

1890..... 2,000, '91, 1012.

Total ..... 41,000

List of appropriations, '92, 898.



**MANASQUAN RIVER, N. J.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 75; '91, 106; '92, 109.

**ENGINEERS IN CHARGE.**

Capt. G. McC. Derby, 1887-'88. Report, '88, 667.

Capt. T. L. Casey, 1891-'— . Reports, '91, 1010; '92, 897.

**ASSISTANT.**

C. S. Kelsey. Report, '91, 1011.

**Operations.**

1887-'88. No operations for lack of funds, '88, 668; '91, 1012; '92, 897.

**Physical Characteristics.**

Description of the river, '88, 667.

**Projects.**

By Col. Maccomb, 1879, for construction of jetties at the inlet to control and to concentrate the scouring action of ebb tides; the improvement of the upper river by dredging and removal of wrecks, logs, and snags; estimated cost, \$52,120, '72, 68, 462, 464; '86, 751.

The Board of Engineers of 1880 considered that the jetties proposed would be insufficient to maintain the desired improvement, '80, 552; '86, 752. Conclusions of Board justified by subsequent experience, '86, 754.

In 1882 Col. Gillespie proposed the extension of the north jetty seaward 255 feet, and for construction of 905 linear feet of jetty on south side; estimated cost, \$40,000, '82, 702; '86, 753.

**MANATEE RIVER, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 280.)

**Appropriations.**

1882-'87 .....	*\$25,000
1888 .....	5,000, '88, 1109.
1890 .....	6,000, '90, 1603.
1892 .....	6,000, '92, 1386.

Total ..... 42,000

List of appropriations, '92, 1385.

**Contracts.**

1888. D. G. Ambler, for dredging, at 29 cents per cubic yard, '89, 1341.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 147; '89, 170; '90, 152; '91, 191; '92, 188.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1886-'92. Reports, '88, 1107; '89, 1340; '90, 1602; '91, 1653.

Maj. J. C. Mallery, 1892-'—. Report, '92, 1384.

**ASSISTANT.**

J. H. Bacon. Report, '88, 1109.

**Operations.**

1887-'88. 15,302 cubic yards material dredged from the cut, '88, 1108.

1888-'89. No operations, '89, 1341.

1889-'90. 14,977 cubic yards material dredged, '90, 1603.

1890-'92. No operations, '91, 1654; '92, 1386.

**Physical Characteristics.**

Description of the river, '88, 1108.

**Projects.**

By Maj. Damrell, 1882, for improvement of Manatee River by the excavation of a channel 100 feet wide and 13 feet deep at mean low water from Tampa Bay to Shaws and McNeills Points, a distance of about 4 miles; estimated cost, \$70,000, '82, 1321; '83, 1028; '86, 1151.

This project was subsequently modified, increasing the estimated cost to \$73,000, to provide for opening up the entire lower river to light-draft boats, by the formation of a channel 100 feet wide and 8 feet deep at mean low water from Tampa Bay to Manatee, '90, 1602; '91, 1653.

**Surveys.**

Of river made, 1888, under direction of Capt. Black, '88, 1108, 1109.

**MAPS.**

Of river, '88, 1108.

\* Of this amount \$2,000 was for Pease River, '87, 1241.

**MANCHESTER HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 281.)

**Appropriations.**

1888.....	\$2,500, '89, 567.
1890.....	5,000, '90, 494.
1892.....	6,800, '92, 570.

Total ..... 14,300

**Contracts.**

1890. Hamilton & Sawyer, for dredging, at 29 cents per cubic yard, and for removal of bowlders, at \$6 each, '91, 639.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 26, 32; '89, 36; '90, 31; '91, 37; '92, 44.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1888-'89. Report, '88, 463, 466.

Lieut. Col. S. M. Mansfield, 1889-'— Reports, '89, 567; '90, 493; '91, 638; '92, 569.

**ASSISTANT.**

S. Haagensen. Report, '88, 467.

**Operations.**

1887-'90. No operations, '88, 463; '89, 567; '90, 493.

1890-'91. 7,316 cubic yards of material dredged, '91, 638.

1891-'92. 14,736 cubic yards material dredged, '92, 569.

**Projects.**

By Lieut. Col. Gillespie, 1887, for improvement of the harbor, restoring the channel to its former depth of from 3 to 4 feet mean low water by the excavation of a channel 4,000 feet long, 60 feet wide, and 4 feet deep from Proctors Point to the town wharves, requiring the removal of 100,000 cubic yards of material, at an estimated cost of \$14,300, '88, 464, 466; '89, 567; '92, 569.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. G. L. Gillespie, '88, 466.

**MAPS.**

'88, 466.

**MANISTEE HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 281.)

**Appropriations.**

1867-'87.....	\$238,000
1888.....	10,000, '88, 1905.
1890.....	50,000, '90, 2617.
1892.....	50,000, '92, 2325.

Total ..... 348,000

List of appropriations, '92, 2324.

**Contracts.**

1889. Charles Berner, for breakwater construction, at a total of \$9,331.02, '89, 2172.

1890. Truman & Cooper, for dredging, at 14 cents per cubic yard, '91, 2680.

1891. C. H. Starke, for dredging, at 14½ cents per cubic yard; Gaylord & Wing, for white pine timber and plank, at \$17 per M feet, B. M.; S. Bedford, for plank, at \$14.50 per M feet, B. M.; G. W. Crouter, for bolts and spikes, at 3 cents per pound; F. A. Hagen, for stone, at \$2.24 per cord, '91, 2681.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 253; '89, 296; '90, 266; '91, 338; '92, 323.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1904.

Maj. Wm. Ludlow, 1889-'— Reports, '89, 2171; '90, 2616, 2618; '91, 2678; '92, 2322.

**Operations.**

1887-'88. South pier extended 50 feet, '88, 1905.

1888-'89. Construction of two cribs begun under contract, '89, 2171.

1889-'90. South pier extended 100 feet; repairs to north pier, '90, 2616.

1890-'91. 57,800 cubic yards material dredged; crib construction in progress, '91, 2678.

**MANISTEE HARBOR, MICH.—Continued.****Operations—Continued.**

1891-'92. 40,784 cubic yards material dredged; 200 linear feet of north pier extension completed; 764 linear feet of north revetment rebuilt; repairs to north pier, '92, 2323.

**Plans.**

By Maj. Ludlow, 1889, for extension of the north pier 550 feet to the 18-foot curve in the lake, and the south pier 350 feet to the 14-foot curve; also for dredging a 15-foot channel between the piers; estimated cost, \$115,000, '90, 2619.

**Projects.**

The project of 1866, with the modifications of 1870 and 1874, proposed the parallel extension of crib piers so as to obtain at least 12 feet depth of channel; estimated cost, \$180,949, '76, 469. Modified in 1870 and 1874 for extension of piers, at a total estimated cost of \$234,000, '80, 2012. In 1886, after an aggregate appropriation of \$248,000, it was estimated that \$92,700 would be required to complete project, '86, 1760.

In 1890, after a further appropriation of \$60,000, Maj. Ludlow estimated \$75,000 as requisite for completion of project, '90, 2617; '91, 2679.

**Surveys.****MAPS.**

'90, 2618.

**MANISTIQUE HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 282.)

**Appropriations.**

1880-'81 ..... \$6,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 235; '89, 274; '90, 247; '91, 317; '92, 303.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1835; '89, 2042; '90, 2326; '91, 2523.

Maj. J. F. Gregory, 1892-'— Report, '92, 2170.

**Operations.**

1887-'92. No operations since 1880, '88, 1835; '89, 2042; '90, 2326; '91, 2524; '92, 2170.

**Projects.**

By Maj. Robert, 1879, for removal of 20,000 cubic yards of sand from between existing piers; estimated cost, \$6,000, '80, 1932.

**Surveys.**

Survey made, 1890, under direction of Maj. Davis, '90, 2326.

**MANITOWOC HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 282.)

**Appropriations.**

1852-'87 ..... \$291,820  
 1888 ..... 8,000, '88, 1852.  
 1890 ..... 8,000, '90, 2345.  
 1892 ..... 28,000, '92, 2192.

Total ..... 335,820

List of appropriations, '92, 2192.

**Commerce.**

Importance of the harbor, '88, 1852.

**Contracts.**

1888. Truman & Cooper, for superstructure reconstruction 400 feet, at \$3,120.80, '89, 2061.

1890. Truman & Cooper, for 600 linear feet of pier superstructure construction, at \$4,884, '91, 2547.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 240; '89, 279; '90, 252; '91, 323; '92, 309.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1851; '89, 2060; '90, 2343; '91, 2545.

Maj. J. F. Gregory, 1892-'— Report, '92, 2191.

**MANITOWOC HARBOR, WIS.—Continued.****Operations.**

- 1887-'88. One crib sunk, extending the south pier 50 feet, and 12,250 linear feet of superstructure completed upon south pier, '88, 1851.  
 1888-'89. 4,490 cubic yards material dredged by city of Manitowoc and private parties; 30,350 cubic yards material dredged by hired labor; 400 linear feet of south pier completed under contract, '89, 2060.  
 1889-'90. No operations, '90, 2344.  
 1890-'91. 9,464 cubic yards material dredged; 400 linear feet of north pier rebuilt, '91, 2546.  
 1891-'92. 342 linear feet of north pier rebuilt; 2,429 cubic yards material dredged, '92, 2192.

**Plans.**

- By Maj. Davis, 1890, for an exterior harbor protection of crib work 400 feet long, built at an angle of 45 degrees with the line of direction of the piers and about 600 feet beyond the lake end of the north pier; estimated cost, \$40,000, '90, 2345.

**Private and Corporate Work.**

- Dredging done by city of Manitowoc and private parties, '89, 2060.

**Projects.**

- The original project of 1866, together with the modifications of 1869, 1872, and 1881, proposed the formation of a channel between two parallel crib piers 250 feet apart, between the 18½-foot curve in the lake and deep water in the river, 14 feet deep at the inner end, increasing to 18 feet at the outer end; estimated cost, \$308,182.54, '81, 2094; '86, 1667; '87, 2044.  
 In 1890 the construction of an exterior breakwater 400 feet in length was proposed, at an estimated cost of \$40,000, which, with \$12,000 for preservation of piers and maintenance of channel, increases the total cost of improvement to \$348,182, '92, 2192.

**Surveys.**

- Survey made, 1890, under direction of Maj. Davis, '90, 2344.

**MAPS.**

- '88, 1852.

**MANOKIN RIVER, MD.—IMPROVEMENT OF.****Appropriations.**

- 1890..... \$7,500, '91, 1197.  
 1892..... 7,500, '92, 977.

Total ..... 15,000

**Contracts.**

1891. F. C. Somers, for dredging, at 15½ cents per cubic yard, '91, 1197.

**Engineers.****CHIEF OF ENGINEERS.**

- Reports, '89, 112; '90, 102; '91, 129; '92, 129.

**ENGINEER IN CHARGE.**

- W. F. Smith, U. S. agent, 1888-'—. Reports, '90, 959; '91, 1195; '92, 976.

**ASSISTANT.**

- A. Stierle. Report, '90, 960.

**Operations.**

- 1890-'91. 42,016 cubic yards material dredged, '91, 1198.  
 1891-'92. No operations, '92, 976.

**Physical Characteristics.**

- Description of the locality, '90, 960.

**Projects.**

- By Mr. W. F. Smith, 1890, for excavation of a channel between Locust and Sharps Points 100 feet wide and 6 feet deep at mean low water; estimated cost, \$30,000, '90, 961; '92, 976.

**Surveys.**

- Ordered by act of August 11, 1888. Made, 1890, under direction of Mr. W. F. Smith, '90, 961.

**MANTUA CREEK, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 283.)

**Appropriations.**

1882..... \$3,000

**Contracts.**

1889. American Dredging Company, for dredging, at 13 cents per cubic yard, '90, 904.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 83; '89, 101; '90, 91.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1885-'90. Reports, '88, 711; '89, 873.

Maj. C. W. Raymond, 1890. Report, '90, 904.

**Operations.**

1887-'89. No operations, '88, 711; '89, 873.

1889-'90. 20,000 cubic yards material dredged from the channel, '90, 904.

**Physical Characteristics.**

Description of the creek, '88, 711.

**Projects.**

By Capt. Ludlow, 1882, for the improvement of Mantua Creek between Mantua and the mouth by excavation of a channel having a low-water depth of 10 feet and a width of 80 feet at the mouth, diminishing to 4 feet depth and 40 feet width at Mantua; estimated cost, \$35,000, '82, 806.

By Lieut. Col. Robert, 1889, for the formation of a dredged channel 60 feet wide and not less than 8 feet deep at mean low water between the 8-foot curve in the Delaware River and the Phosphate Wharf, a distance of about 3,000 feet; estimated cost, \$2,900, '89, 874.

**MARCUS HOOK, PA.—ICE HARBOR AT.**

(Continued from Vol. II, p. 284.)

**Appropriations.**

1829-'87..... \$199,000

1888..... 15,000, '88, 704.

1890..... 5,000, '90, 887.

Total ..... 219,000

List of appropriations, '92, 830.

**Contracts.**

1888. F. C. Somers, for dredging, at 14 cents per cubic yard. H. H. Dambly, for repairs to piers and placing mooring piles, for a lump sum of \$1,557.50, '89, 888.

1892. Davis &amp; Irvin, for repairs to landing piers and placing 7 groups of mooring piles, at a total of \$1,014, '92, 930.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 79; '89, 98; '90, 88; '91, 113; '92, 114.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1885-'90. Reports, '88, 701; '89, 866.

Maj. C. W. Raymond, 1890-'—. Reports, '90, 886; '91, 1072; '92, 929.

**Operations.**

1887-'88. 58,000 cubic yards material dredged from shoal area at lower end of harbor; proposed new pier completed; pile foundations of Pier No. 6 removed, and two groups of mooring piles placed between existing piers, '88, 702.

1888-'89. 100,000 cubic yards material dredged and landing piers repaired, '89, 867.

1889-'92. No operations, '90, 887; '91, 1072; '92, 930.

**Projects.**

The original project of 1866, with the amendments thereto, proposes the formation of a harbor for the protection of vessels against moving ice by the construction of stone piers behind which vessels can anchor, and the formation of a bulkhead about 1,800 feet long, parallel with the shore line and about 150 feet outside of high-water line, together with the deepening, by dredging, of the area behind the piers and in front of the bulkhead, '86, 117. Total amount appropriated from 1829 to 1886, inclusive, \$199,000; amount required to complete project, \$3,000, '86, 833.

**MARCUS HOOK, PA.—Continued.****Projects—Continued.**

By Lieut. Col. Robert, 1888, for excavation of the harbor to 24 feet mean low water outside the line running midway between each pair of ice piers; from this line gradually diminishing to 18 feet along the line running midway between the inner ice piers and the landing piers, gradually diminishing to 12 feet on the line joining the head of the landing piers, from which latter line the bottom would take a gentle slope of about one on six until it reaches the natural bottom. Amount of dredging required, about 100,000 cubic yards. The project also provides for the reconstruction of the upper courses upon two of the U. S. Landing Piers; estimated cost, \$20,000, '89, 867.

**Surveys.****MAPS.**

'88, 702.

**MARQUETTE HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 285.)

**Appropriations.**

1867-'87 .....	\$329, 230
1888 .....	25, 000, '88, 1831.
1890 .....	40, 000, '90, 2302.
1892 .....	80, 000, '91, 2144.

Total ..... 474, 230

List of appropriations, '89, 2021.

**Contracts.**

1889. Morrison & Hannah, for breakwater construction, substructure at \$92.90 and superstructure at \$17.10 per running foot, '89, 2022.

1891. C. Berner, for crib breakwater construction, at a total of \$28,080, '91, 2508.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 1831; '89, 272, 366, 2027, 2031, 2038; '90, 245; '91, 315; '92, 300.

**BOARD OF ENGINEERS.**

Convened at Marquette, November 27, 1888, by S. O. No. 64, to report upon the establishment of harbor lines in Marquette Harbor, Mich. Report, '89, 2032. (Majs. Davis, Allen, and Quinn.)

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'89. Report, '88, 1831.

Maj. J. B. Quinn, 1889-'91. Reports, '89, 2021, 2027, 2028, 2039; '90, 2300.

Capt. W. L. Fisk, 1891-'—. Reports, '91, 2505; '92, 2142.

**Operations.**

Repairs to breakwater made by hired labor, '88, 1831.

1887-'89. No operations, '88, 1831; '89, 2021.

1889-'90. 180 linear feet of breakwater built, '90, 2300.

1890-'91. Repairs to superstructure, '91, 2506.

1891-'92. Breakwater extension in progress; repairs to superstructure, '92, 2143.

**Projects.**

By Maj. W. F. Reynolds, 1866, for a crib breakwater filled with stone, extending from north side of harbor southerly for a distance of 2,000 linear feet, with a width of 20 feet at inner end, increasing to 30 feet at outer end; when completed to be 5 feet above water, '66, iv, 79, 80, 82; '86, 291; estimated cost, \$385,129, '66, iii, 8; iv, 81.

In 1875 the breakwater was completed to a length of 2,010 feet, at a cost of \$92,000 less than original estimate, '76, ii, 330; '86, 291. Maj. Robert then proposed an additional extension of 400 linear feet, at an additional cost of \$68,000, '75, i, 189; '86, 282.

In 1888 Maj. Davis provided for the extension of the breakwater for a distance of 1,200 feet, at an estimated cost of \$200,000, '88, 1831.

In 1889 the length of the projected breakwater was reduced by Maj. Quinn to 1,000 feet, at a cost of \$121,000, '89, 2021.

In 1890 Maj. Quinn proposed the addition of a concrete superstructure to the 2,000 linear feet of breakwater built under the project of 1866; estimated cost, \$149,454.36. This, together with the cost of breakwater extension as projected in 1889, made a total of \$270,454.36 for completion in 1890, '90, 2301.

**MARTHAS VINEYARD, inner and outer harbor at Edgartown, Mass.—IMPROVEMENT OF.**

(See also EDGARTOWN HARBOR, Mass.)

**Appropriations.**

1890..... \$2,000, '91, 699.  
 1892..... 2,500, '92, 604.

Total ..... 4,500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 56; '90, 50; '91, 49; '92, 53.

**ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1888-'92. Reports, '90, 585; '91, 698.

Capt. W. H. Bixby, 1892-'—. Report, '92, 602.

**Operations.**

1890-'91. No operations, '91, 698.

1891-'92. 15,385 cubic yards material dredged by hired labor, '92, 603.

**Physical Characteristics.**

Description of the locality, '90, 586.

**Plans.**

By Maj. Livermore, 1889, for improvement of the outer harbor of Edgartown by construction of an ice breaker and breakwater of riprap granite; estimated cost, \$96,800, '90, 586.

**Projects.**

By Maj. Livermore, 1891, for removal of a shoal called "Middle Ground" in the center of the harbor to a depth of 10 feet at mean low water; estimated cost, \$4,500, '91, 698; '92, 603.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Livermore, '90, 587.

**MATAGORDA BAY, TEX.—IMPROVEMENT OF ENTRANCE TO.**

(Continued from Vol. II, p. 175.)

**Appropriations.**

1876-'87 ..... \$327,500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 175; '89, 205.

**BOARD OF ENGINEERS.**

Convened at New York, November 11, 1887, to examine and report upon the advisability of continuing further improvements at Pass Cavallo. Report, '88, 1299. (Cols. Casey and Abbot, Lieut. Col. McFarland, and Maj. King.)

**ENGINEER IN CHARGE.**

Maj. O. H. Ernst, 1886-'89. Reports, '88, 1301, 1302; '89, 1564.

**Operations.**

1887-'88. The Board of Engineers of 1887 recommended, in view of Maj. Ernst's report for that year, that no further improvements be attempted at Pass Cavallo, '88, 1300, 1306.

**Projects.**

The Board of Engineers recommended the extension of a jetty from the head of Matagorda Island in a southeastern direction, and the construction of groins and transverse jetties for shore protection, the object being to obtain a 12-foot channel across the bar and protect the head of Matagorda Island; estimated cost, \$1,039,280, '80, 1258, 1260; '86, 1329; '87, 1430.

In 1887, in view of the failure of existing works to accomplish the desired result, the Board of Engineers recommended that no further works of improvement be undertaken at this locality, '88, 1300.

**Surveys.**

Of Pass Cavallo. Made, 1887, under direction of Maj. Ernst, '88, 1302.

**MATTAPONI RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 287.)

**Appropriations.**

1880-'87 .....	\$13,300
1888 .....	3,000, '88, 827.
1890 .....	3,000, '90, 1073.
1892 .....	4,000, '92, 1061.

Total ..... 23,300

List of appropriations, '88, 827.

**Contracts.**

1891. H. T. Morrison &amp; Co., for construction of plant, at a total of \$6,129, '92, 1060.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 112; '89, 129; '90, 116; '91, 144; '92, 145.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1875-'91. Reports, '88, 826; '89, 1012; '90, 1072.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1273.

Maj. C. E. L. B. Davis, 1892-'—. Report, '92, 1059.

**Operations.**

1887-'88. 1,179 linear feet of pile dike built, and 430 logs, snags, trees, and stumps removed; 29 mats built and sunk, '88, 827.

1888-'89. 79 round piles and 2,400 feet, B. M., sheet piles driven, and 102 linear feet wall pieces fastened by hired labor, '89, 1012.

1889-'90. Dikes already in process of construction finished, and 243 linear feet of additional work built by hired labor, '90, 1072.

1890-'91. No operations, '91, 1274.

1891-'92. 165 snags, 27 logs, and 270 overhanging trees removed, '92, 1060.

**Projects.**

By S. T. Abert, 1875, for removal of snags and wrecks, and excavation of channel from head of navigation to Line Tree Bar, having a width of 40 feet and a depth of 5½ feet at low water; estimated cost, \$34,059, '75, ii, 169, 170.

In 1884 S. T. Abert proposed, in addition to the previous project, the construction of dikes at Robinson and Latanes bars, at an estimated cost of \$38,000, '85, 979; '86, 143, 916; '87, 941.

**Surveys.****MAPS.**

'88, 827.

**MATTAWAN CREEK, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 287.)

**Appropriations.**

1881-'82 .....	\$21,000
1890 .....	2,500, '91, 1003.
1892 .....	9,620, '92, 891.

Total ..... 33,120

List of appropriations, '92, 891.

**Contracts.**

1891. Atlantic Dredging Company, for dredging, at 37½ cents per cubic yard, '91, 1003.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 74; '91, 104; '92, 107.

**ENGINEERS IN CHARGE.**

Capt. G. McC. Derby, 1887-'90. Report, '88, 663.

Capt. T. L. Casey, 1890-'—. Reports, '91, 1003; '92, 890.

**Operations.**

1887-'91. No operations, '88, 664; '91, 1003.

1891-'92. 5,028 cubic yards material dredged, '92, 891.

**Physical Characteristics.**

Description of the creek, '88, 663.

**Projects.**

By Lieut. Col. Michler, 1880, for formation of a channel, by dredging, 4 feet deep at mean low water and 100 feet wide from the mouth up to Winkson Creek, a distance of about 2 miles, to the head of navigation at the Long Branch Railroad Bridge 4 feet deep at mean low water and 75 feet wide; estimated cost, \$33,120, '81, 722; '86, 762; '91, 1003.



**MATTITUCK BAY, N. J.—EXAMINATION FOR BREAKWATER AT.****Commerce.**

Present and prospective commercial interests of Mattituck, '91, 846.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 80.

ENGINEER IN CHARGE.

Col. D. C. Houston. Report, '91, 843.

**Physical Characteristics.**

Description of the inlet and bay, '91, 843.

**Plans.**

By Col. Houston, 1891, for formation of a channel 7 feet deep at low tide from Long Island Sound up to the tide mill at Mattituck, 100 feet wide at the entrance, and thence to the mill to be 80 feet wide, the entrance channel to be secured by the construction of parallel jetties extending from the shore out to the 9-foot curve in Long Island Sound; estimated cost, \$83,000, '91, 845.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Col. Houston, '91, 843.

**MAURICE RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 289.)

**Appropriations.**

1882-'87 .....	\$25, 000
1888 .....	10, 000, '88, 738.
1890 .....	8, 000, '90, 916.

Total .....

43, 000

List of appropriations, '90, 916.

**Commerce.**

Increase in amount of shipping consequent upon improvement, '88, 739.

**Contracts.**

1889. American Dredging Company, for dredging, at 15 cents per cubic yard, '90, 916.

1891. American Dredging Company, for dredging, at 19 cents per cubic yard, '91, 1089.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 86; '89, 102; '90, 92; '91, 117; '92, 119.

ENGINEERS IN CHARGE.

W. F. Smith, U. S. agent, 1885-'91. Reports, '88, 738; '89, 880; '90, 916.

Maj. C. W. Raymond, 1891-'— Reports, '91, 1089; '92, 938.

**Operations.**

1887-'88. 29,363 cubic yards material dredged from the channel, '88, 738.

1888-'89. No operations, '89, 880.

1889-'90. 49,918 cubic yards material dredged, '90, 916.

1890-'91. 6,785 cubic yards material dredged, '91, 1088.

1891-'92. 37,392 cubic yards material dredged, '92, 939.

**Projects.**

By Capt. Ludlow, 1882, for improvement of Maurice River, between Millville and its mouth, by excavation of a channel 100 feet wide and 4 feet deep at mean low water, commencing  $2\frac{1}{2}$  miles below the bridge at Millville to a point called Pea Landing; also a cut of the same width and depth through a point of land at Silver River; from Pea Landing to the bridge the channel to be 4 feet deep and 60 feet wide for a distance of 400 feet above the bridge, the 100-foot width to be resumed, being reduced to 50 feet for the next 500-foot length; estimated cost, \$114,500, '82, 811; '85, 868; '87, 86; '92, 938.

**MEDOMAC RIVER, ME.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 31.

ENGINEER IN CHARGE.

Lieut. Col. J. A. Smith, 1888. Report, '89, 549.

**MEDOMAC RIVER, ME.—Continued.****Physical Characteristics.**

Description of the locality, '89, 549.

**Plans.**

In 1888 Lieut. Col. Smith did not consider that the general commerce of the locality warranted an improvement of the river, '89, 549.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Smith, '89, 549.

**MEADOW RIVER, W. VA.—EXAMINATION OF.**

(Continued from Vol. II, p. 289.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 226.

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1886. Report, '88, 1761.

ASSISTANT.

N. H. Hutton. Report, '88, 1762.

**Physical Characteristics.**

Description of the locality, '88, 1761.

**Plans.**

By Col. Craighill, 1887, for clearing Meadow River to facilitate the rafting of logs, at an estimated cost of \$45,000, '88, 1762.

**Surveys.**

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Col. Craighill, '88, 1761.

MAPS.

'88, 1762.

**MEHERRIN RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 290.)

**Appropriations.**

1882..... \$5,000

**Engineers.**

ENGINEER IN CHARGE.

Col. W. P. Craighill, 1888. Report, '88, 773.

**Operations.**

1887-'88. No operations, '88, 773.

**Projects.**

By Capt. Mercur, 1882, for removal of snags, logs, and similar obstructions to secure a 9-foot channel 80 feet in width from the mouth to Murfreesboro; estimated cost, \$125,000, '82, 1115.

In 1888 Col. Craighill stated that no permanent benefit was to be derived from the improvement, '88, 773.

**MEMPHIS HARBOR, TENN.—EXAMINATION FOR REMOVAL OF BAR IN THE MISSISSIPPI OPPOSITE.****Appropriations.**

1892..... \$25,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 258.

ENGINEERS IN CHARGE.

Capt. S. W. Roessler, 1891. Report, '91, 3537.

Col. C. B. Comstock, 1891. Report, '91, 258.

**MEMPHIS HARBOR, TENN.—Continued.****Plans.**

In 1891 Col. Comstock reported that in view of its great cost and uncertain results an improvement at this locality should not be undertaken by the United States, '91, 258.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Roessler, '91, 3587.

**MENEMSHA BITE (BIGHT), MASS.—SURVEY OF.**

(Continued from Vol. II, p. 290.)

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 62; '92, 66.

ENGINEER IN CHARGE.

Maj. W. R. Livermore. Report, '92, 642.

**Physical Characteristics.**

Description of the locality, '92, 642.

**Plans.**

By Maj. Livermore, 1891, for confining the current and producing a scour across the bar by the construction of brush and stone jetties extending out from the banks on either side of the mouth of the outlet to 10 feet of water in the bight; estimated cost, \$20,000. In view of the uncertainty of maintenance and the present demands of commerce, Maj. Livermore considered the expediency of the improvement doubtful, '92, 645.

**MENOMONEE HARBOR, MICH. AND WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 291.)

**Appropriations.**

1882-'87 .....	\$203,000
1888 .....	9,000, '88, 1838.
1890 .....	54,000, '90, 2329.

Total .....	266,000
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List of appropriations, '92, 2174.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 236; '89, 275, 287; '90, 248.

ENGINEERS IN CHARGE.

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1837; '89, 2044; '90, 2328; '91, 2527.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2173.

**Operations.**

1887-'89. No operations, '88, 1837; '89, 2045.

1889-'90. 610 linear feet of north pier rebuilt above the water line, and 1,105 cubic yards material dredged by hired labor, '90, 2329.

1890-'91. 14,170 cubic yards material dredged, '91, 2527.

1891-'92. Channel excavation completed, '92, 2174.

**Projects.**

By Maj. Houston, 1871-'74, for the extension of two parallel piers about 400 feet apart to the 16-foot curve in the bay, with dredging between the piers to afford a channel between the entrance and deep water in the river 14 feet deep; estimated cost, \$212,000, '71, 109; '72, 115; '74, 139; '84, 1835; '86, 1652.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Davis, '89, 2045.

**MENOMONEE RIVER, WIS.—IMPROVEMENT OF.****Appropriations.**

1892..... \$20,500, '92, 2176.

**Contracts.**

1890. Truman & Cooper, for dredging, at 10½ cents and 11½ cents per cubic yard, '91, 2530.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '90, 259; '91, 318; '92, 304.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1889-'92. Reports, '90, 2394; '91, 2528.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2175.

**ASSISTANT.**

L. M. Mann. Report, '90, 2396.

**Operations.**

1890-'91. 26,058 cubic yards material dredged, '91, 2529.

1891-'92. 126,047 cubic yards material dredged, '92, 2176.

**Projects.**

By Maj. Davis, 1889, for improvement of the river by the formation of a dredged channel 16 feet deep and 200 feet wide, from Green Bay to Ludington & Co.'s Mill, a distance of about 2 miles; estimated cost, \$109,609, '90, 2396; '92, 2528. Width of channel reduced to 100 feet for a distance of 2,600 feet, reducing the estimated cost of project to \$74,500, '92, 2530.

In 1892, after expenditure of \$74,500, it was estimated that \$10,000 would be required for maintenance of improved channel, '92, 2176.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Davis, '90, 2395.

**MERMENTOU RIVER, LA.—SURVEY OF.****Appropriations.**

1892..... \$7,500

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 230.

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1891. Report, '91, 1858.

Maj. J. B. Quinn, 1891. Report, '91, 1862.

**ASSISTANT.**

P. H. Thompson. Report, '91, 1859, 1863.

**Physical Characteristics.**

Description of the locality, '91, 1859.

**Plans.**

By Maj. Quinn, 1891, for clearing the river of obstructions from Viterboville to the mouth, and construction of a brush dam at Lower Mud Lake, at an estimated cost of \$23,615. Also construction of jetties at the mouth, to give deep water over the bar, at an estimated cost of \$781,210. '91, 1863.

**Surveys.**

Survey made, 1891, under direction of Maj. Quinn, '91, 1862.

**MERRIMAC RIVER, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 292.)

**Appropriations.**

1828-'84 .....	\$230,866.72
1890 .....	10,000.00, '90, 485.
1892 .....	1,500.00, '92, 555.

Total .....	242,366.72
List of appropriations, '86, 561.	

**MERRIMAC RIVER, MASS.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 23; '89, 33; '90, 27; '91, 34; '92, 40.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 436.

Lieut. Col. S. M. Mansfield, 1889-'— . Reports, '89, 556; '90, 484; '91, 628; '92, 554.

**Operations.**

1887-'90. No operations, '88, 437; '89, 557; '90, 485; '91, 629; '92, 554.

**Physical Characteristics.**

Description of the river, '88, 436.

**Projects.**

Between 1828 and 1834, inclusive, \$60,366.72 were appropriated for the removal of a sand bar and the construction of a breakwater at the river's mouth.

The original project, 1869, proposed the removal of obstructions from the upper and lower falls of Gangway Rock, the Boilers, and a wreck near the mouth; estimated cost, \$69,025, '69, 421; '70, 469, 473; '76, i, 165; '86, 61.

In 1874 the project was extended to include the removal of rocks at Deer Island and at Rocks Bridge and Little Currier Shoal, so as to give channel depths at ordinary high water as follows: From mouth to Deer Island Bridge, 16½ feet; thence to Haverhill Bridge, 12 feet; thence to foot of Mitchells Falls, 10 feet; thence to head of Upper Falls, 4½ feet; estimated cost, including project of 1869, \$147,000, '76, i, 165; '86, 61; '87, 494. Project completed in 1884, with the exception of the removal of the "Boilers," under an aggregate appropriation of \$167,000, when it was estimated that \$26,000 additional would be required for the further improvement of the river between Plumb Island Light and Lawrence, '82, 534, 541; '84, 501; '86, 561; '87, 494.

From 1883-'86 additional improvements were recommended by Maj. Raymond for the river below Mitchells Falls, including removal of the "Boilers" and sunken rocks at the Falls, at an estimated cost of \$11,500, '90, 485.

In 1892 \$11,000 was estimated as required for the extension of the improvement to Lawrence, 5 miles above the Falls, '92, 555.

**Surveys.****MAPS.**

'89, 556.

**MICHIGAN CITY HARBOR, IND.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 293.)

**Appropriations.****OUTER HARBOR.**

1836-'87 .....	\$891, 763. 92
1888 .....	90, 000. 00, '88, 1920.
1890 .....	50, 000. 00, '90, 2665.
1892 .....	30, 000. 00, '92, 2367.

Total ..... 1, 061, 763. 92

**INNER HARBOR.**

1880-'87 .....	\$71, 875. 00
1888 .....	5, 000. 00, '88, 1921.
1890 .....	7, 500. 00, '90, 2668.
1892 .....	15, 000. 00, '92, 2368.

Total ..... 99, 375. 00

List of appropriations for outer and inner harbors, '92, 2367.

**Contracts.**

1889. H. B. Herr & Co., for outer harbor breakwater construction, at a total of \$69,239.17, '89, 2200.

1890. H. B. Herr & Co., for white pine timber, at \$17.90 per M foot, B. M., '90, 2666. Parkhurst & Wilkinson, for drift bolts and spikes, at 2½ to 2¼ cents per pound; E. G. Crosby, for timber, at \$18.50 per M feet, B. M.; J. S. Hopper & Sons, for plank, at \$13 per M feet, B. M., '91, 2708.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 258; '89, 304; '90, 273; '91, 344; '92, 330.

**MICHIGAN CITY HARBOR, IND.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1919.

Maj. W. Ludlow, 1889-'—. Reports, '89, 2197; '90, 2662; '91, 2706; '92, 2366.

**Operations.**

1887-'88. Outer harbor: 542 linear feet of pile portion of west pier rebuilt; entire west pier filling replaced, and general repairs to breakwater. Inner harbor: 4,510 cubic yards material dredged, '88, 1919, 1920.

1888-'89. Outer harbor: Outer end of west pier decked over; "Breakwater Pier" completed by construction and placing of 150 linear feet of crib work. Inner harbor: 64,085 cubic yards material dredged, '89, 2199, 2201.

1889-'90. Outer harbor: 500 linear feet of new breakwater work built; repairs to prior breakwater construction. Inner harbor: 24,740 cubic yards material dredged, '90, 2665, 2666.

1890-'91. Outer harbor: Reconstruction of the 3 outer cribs of the breakwater pier completed; repairs to outer 535 feet of the west pile pier; leveling up of outer breakwater superstructure, '91, 2706. Inner harbor: No operations, '91, 2707.

1891-'92. Outer harbor: Repairs to breakwater; superstructure completed over the 500 feet of crib work in the outer breakwater, '92, 2366. Inner harbor: Repairs to dredging plant; 84,893 cubic yards material dredged, '92, 2368.

**Projects.**

Work at this harbor was commenced by the United States in 1836. Between this date and 1852 \$156,203.92 was appropriated, including relief claims, and applied to dredging, crib construction at the entrance of the harbor, and the commencement of a breakwater covering the entrance, '67, 98; '76, ii, 447; S. Doc. 42, Thirty-fifth Congress, first session, pages 74, 175.

In 1866 previous constructions had practically disappeared by decay and destruction when the work was resumed under an appropriation of \$75,000, with the proviso that it was to be available when \$100,000 had been expended by the Michigan City Harbor Company, '67, 23, 96, 100. Between 1866 and 1870 the project proposed the formation of a channel entrance 12 feet deep, to be obtained by pier extension and dredging, '67, 95, 97; '68, 32, 112, 117; '69, 28; '70, 97.

Between 1866 and 1869, inclusive, \$131,185 was appropriated. In 1870 the project was adopted for deepening, by dredging, the inner harbor to the railroad bridge, '70, 97.

In 1870 a Board of Engineers recommended the construction of an outer harbor and the deepening, by dredging, of the basin to a uniform depth of 14 feet, at an estimated cost of \$324,421.40, '70, 125; '76, ii, 449; '77, 898; '78, 1188; '79, 1592; '80, 2006. Between 1870 and 1879, inclusive, \$392,500, was appropriated.

In 1879 the project of 1870 for deepening the inner harbor was modified so as to extend it farther up Trail Creek, for a width of 120 feet and a depth of 15 feet, '79, 1593.

In 1880 a Board of Engineers recommended the extension of a pier 400 feet long from the west end of the breakwater, at right angles thereto, and a second pier 300 feet long and 300 feet to the west, the west extension to be connected with the outer end of the existing west pier by fender piling; also the removal of the old east (river) pier to a point 1,100 feet south of the inner face of the breakwater, and the extension of the breakwater eastward to close the opening proposed at the northeast angle of the harbor in 1877, '81, 2188; '82, 2263.

The Board of Engineers of 1882 approved of Maj. Smith's plan for a masonry and concrete superstructure on the remaining east 166 inner feet to be built in completion of the breakwater; also the plan for an exterior breakwater 2,000 feet in length and covering the entrance to the harbor from northerly and northeasterly gales, with the ultimate removal of about 500 feet of the existing west pier at harbor entrance, '82, 2264, 2266, 2270.

Between 1880 and 1886, inclusive, \$224,375 was appropriated for the outer and \$71,875 for the inner harbor, when it was estimated that \$395,625 would be required for the completion of the former and \$3,125 for the latter, '86, 317. Increased to \$8,125 in 1888, '88, 1921. Estimate for completion of outer harbor increased by \$24,000 in 1889, '89, 2200.

**Surveys.****MAPS.**

'90, 2666.

**MILFORD HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. '295.)

**Appropriations.**

1874-'82 .....	\$38,000
1888 .....	5,000, '88, 550.
1890 .....	2,500, '91, 772.

Total ..... 45,500

List of appropriations, '88, 550.

**Contracts.**

1889. Hartford Dredging Company, for dredging, at 18 cents per cubic yard, '89, 688.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 49; '89, 61; '90, 55; '91, 69; '92, 73.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1886-'—. Reports, '88, 548; '89, 685; '90, 626, 629; '91, 770; '92, 677.

**Operations.**

1887-'88. No operations, '88, 549.

1888-'89. 18,000 cubic yards material dredged, '89, 687.

1889-'90. 10 tons stone removed from channel and placed upon Long Jetty; projected improvement practically completed, '90, 628.

1890-'91. 170 tons of stone used in repairing 160 linear feet of Long Jetty, '91, 772.

1891-'92. 670 tons of granite delivered and placed in repair of Long Jetty, '92, 679.

**Physical Characteristics.**

Description of the harbor, '88, 548.

**Projects.**

By Maj. Warren, 1872, for a breakwater extending from Welch's Point about 890 feet long; protection of bluffs from erosion on east shore of harbor by means of small jetties; dredging a channel across the bar at the mouth of the Wepanwog River 100 feet wide and 4 feet deep; construction of a jetty about 550 feet long on the east side of the channel to aid the action of the tide and prevent the dredged area from refilling; estimated cost, \$85,000, '73, 1043, 1044; '74, ii, 260; '86, 640.

The project, except the breakwater, was completed in 1881, under aggregate appropriations of \$33,000, when Maj. Barlow proposed the formation of a dredged channel through the bar at the mouth of the river from the bay to Merwin's Wharf 100 feet wide and 8 feet deep, at an estimated cost of \$11,000, '81, 599; '82, 614; '84, 96; '86, 641; '91, 771.

**MILWAUKEE BAY, WIS.—HARBOR OF REFUGE AT.**

(Continued from Vol. II, p. 296.)

**Appropriations.**

1881-'87 .....	\$345,000
1888 .....	70,000, '88, 1860.
1890 .....	80,000, '90, 2353.
1892 .....	75,000, '92, 2200.

Total ..... 570,000

List of appropriations, '92, 2200.

**Contracts.**

1888. C. H. Starke, for 400 linear feet breakwater construction, at a total of \$43,992.28, '89, 2069.

1890. C. H. Starke, for 400 linear feet of breakwater extension and superstructure, at a total of \$52,711, '91, 2559.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 242; '89, 281; '90, 254; '91, 325; '92, 311.

ENGINEERS IN CHARGE.

Capt. W. L. Marshall, 1884-'89. Report, '88, 1859.

Maj. C. E. L. B. Davis, 1889-'92. Reports, '89, 2067; '90, 2351; '91, 2553.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2199.

ASSISTANT.

W. H. Hearing. Report, '88, 1861.

**MILWAUKEE BAY, WIS.—Continued.****Operations.**

1887-'88. 100 linear feet of substructure and 400 linear feet of superstructure completed, '88, 1860.

1888-'89. 50 linear feet of breakwater extension built under contract, '89, 2068.

1889-'90. Main arm of breakwater extended 200 feet; also 225 linear feet superstructure built, '90, 2351.

1890-'91. Repair and extension of breakwater, '91, 2554.

1891-'92. 525 linear feet of breakwater extension completed, '92, 2199.

**Projects.**

By Col. Houston, 1880, for the formation of a harbor of refuge in Milwaukee Bay by an artificial harbor inclosing a part of Lake Michigan within an outer breakwater of crib work upon a random stone foundation; estimated cost, \$800,000, '81, 2117, 2119, 2121. Recommendations of Board of Engineers, '81, 2121, 2122.

Plan of Capt. Marshall for a concrete superstructure faced with cast iron, '87, 2060. Approved for trial by Board of Engineers, '87, 2061.

In 1889 it was recommended that the execution of the concrete superstructure be suspended, and that the works be continued according to the plan previously followed. Recommendation approved, '89, 2068.

**MILWAUKEE HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 297.)

**Appropriations.**

1886-'82 .....	\$363,987.45
1888 .....	10,000.00, '88, 1863.
1890 .....	{ 6,100.00, act of March 17, 1890.
1892 .....	{ 6,000.00, '90, 2355.
1892 .....	14,000.00, '92, 2202.

Total ..... 400,087.45

List of appropriations, '92, 2202.

**Contracts.**

1889. W. T. Casgrain, for reconstruction of 400 linear feet of superstructure, at a total of \$7,263.20, '89, 2074.

1890. C. H. Starke, for dredging, at 25 cents per cubic yard, '90, 2354.

1891. C. H. Starke, for dredging, at 18 cents per cubic yard, '92, 2202.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 243; '89, 282; '90, 254; '91, 325; '92, 311.

**ENGINEERS IN CHARGE.**

Capt. W. L. Marshall, 1884-'89. Report, '88, 1862.

Maj. C. E. L. B. Davis, 1889-'92. Reports, '89, 2072; '90, 2353; '91, 2560.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2201.

**ASSISTANT.**

W. H. Hearing. Report, '88, 1863.

**Operations.**

1887-'88. 336 linear feet of superstructure rebuilt, '88, 1868.

1888-'89. 340 linear feet of outer section of south pier rebuilt, '89, 2073.

1889-'90. 60 linear feet of north pier superstructure built; 22,224 cubic yards material dredged, '90, 2354.

1890-'91. No operations, '91, 2560.

1891-'92. 25,896 cubic yards of material dredged from the channel between the piers; repairs to north pier, '92, 2201.

**Projects.**

The improvement of the natural outlet of the river was undertaken in 1843 by the sinking of cribs out to the 10-foot curve and the dredging of a channel between the piers, '76, ii, 385; '80, 1933.

The project from which the present improvement has grown was adopted in 1852, and proposed cutting across the point overlapping the mouth of the river at a point 3,000 feet north of the natural outlet. By the extension of parallel piers about 260 feet apart it was proposed to maintain a channel 12 feet deep. In 1867 the project was modified to provide for a channel 16 feet deep, '68, 80; '69, 27.



**MILWAUKEE HARBOR, WIS.—Continued.****Projects—Continued.**

In 1874 a stone superstructure for a part of the north pier was adopted, '74, i, 151; '75, i, 211; '77, 869. Since that date the project has been completed by the formation of a channel 18 feet deep by an aggregate of appropriations from 1852 to 1882 of \$313,587.45, and expenditures of the city of Milwaukee amounting to \$321,355.66, '82, 276.

In 1889 Maj. Davis estimated \$20,000 as the amount required to rebuild the south pier superstructure and repair the north pier, '89, 2073.

**MINGO CREEK, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 298.)

**Appropriations.**

1888.....	\$5,000, '88, 130.
1890.....	5,000, '90, 1201.
1892.....	3,000, '92, 1209.

Total ..... 13,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 130; '89, 150; '90, 135.

**ENGINEER IN CHARGE.**

Capt. F. V. Abbot, 1888-'—. Reports, '89, 1161; '90, 1200; '91, 1455; '92, 1208.

**ASSISTANT.**

R. Whitford. Reports, '89, 1162; '90, 1201; '91, 1456; '92, 1209.

**Operations.**

1887-'88. No operations, '88, 130.

1888-'89. 300 logs, snags, and trees removed from channel, and 1,306 trees and 429 cords of brush cut from the banks, '89, 1162.

1889-'90. 424 logs and snags and 22 cords small snags removed from channel, and 1,309 trees and 796 cords brush cut from banks, '90, 1201.

1890-'91. 1,042 snags and logs removed from the channel, and 2,412 trees and 444 cords of brush cleared from the banks, '91, 1456.

1891-'92. 422 snags and logs removed from the channel, and 2,632 trees and 378 cords of brush cleared from the banks, '92, 1210.

**Physical Characteristics.**

Description of the creek, '89, 1162, 1163.

**Projects.**

By Capt. Bixby, 1887, for the improvement of the creek for steamboats from its mouth to Williams Landing, a distance of 21 miles, and for pole boats at high water up to the head of navigation by removal of snags, logs, trees, and similar obstructions; estimated cost, \$17,000, '87, 1108; '89, 1161; '92, 1208.

**Surveys.****MAPS.**

'90, 1202.

**MINNESOTA POINT, SUPERIOR BAY, MINN.—IMPROVEMENT OF.****Appropriations.**

1890.....	\$4,895, '91, 2499.
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**Contracts.**

1891. Campbell & McDonald, for sand-fence construction, at \$3.45 per running foot, '91, 2499.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 274; '90, 247; '91, 313; '92, 299.

**ENGINEERS IN CHARGE.**

Maj. J. B. Quinn, 1888-'91. Report, '90, 2306, 2307.

Capt. W. L. Fisk, 1891-'—. Reports, '91, 2499; '92, 2137.

**Operations.**

1890-'91. 1,216 linear feet of sand fence built, completing the project, '91, 2499.

**Physical Characteristics.**

Description of the locality, '90, 2306.

**MINNESOTA POINT, SUPERIOR BAY, MINN.—Continued.****Projects.**

By Maj. Quinn, 1889, to preserve Minnesota Point from the inroads of the lake by the construction of 1,216 linear feet of sand fence, at an estimated cost of \$4,895, '90, 2308. Project completed in 1891, '91, 2499.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Quinn, '90, 2307.

**MINNESOTA RIVER, MINN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 299.)

**Appropriations.**

1867-'79 .....	\$117,500
1888.....	10,000, '88, 1551.

Total .....	127,500
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List of appropriations, '88, 1551.

**Commerce.**

Present and prospective commerce of the Minnesota valley, '88, 1572, 1582.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 204, 206; '89, 238; '90, 213; '91, 271; '92, 260.

**ENGINEERS IN CHARGE.**

Maj. C. J. Allen, 1878-'90. Reports, '88, 1551, 1571, 1574; '89, 1803.

Maj. W. A. Jones, 1890-'—. Reports, '90, 2090; '91, 2207; '92, 1840.

**ASSISTANT.**

F. T. Hampton. Report, '88, 1572.

**Operations.**

1887-'90. No operations for lack of funds, '88, 1551; '89, 1805; '90, 2092; '91, 2209; '92, 1842.

**Physical Characteristics.**

Discharge of the river, '88, 1575.

**Plans.**

By Maj. Allen, 1888, for improvement of the river, giving a slack-water navigation by (1) the construction of 6 masonry locks and movable dams with from 7 to 14 foot lifts; also removal of snags; estimated cost, \$1,527,738; (2) by the construction of 10 masonry locks and movable dams with lifts from 6 to 8.3 feet; also removal of snags; estimated cost, \$1,883,968, '88, 1580.

**Projects.**

The project under which operations have been carried on since the date of the first appropriation in 1867 was the removal of snags, trees, rock, and bowlders from the channel; from 1867 to 1879, inclusive, \$117,500 was appropriated and applied toward this project, '67, 259; '80, 181; '86, 1496.

The project of 1867 for the permanent improvement of the river, modified by the surveys of 1874-'75, proposed a slack-water navigation from the mouth to South Bend, 116 miles, by means of canals, locks, and dams, at an estimated cost, including \$34,585.10 for clearing the river of obstructions, of \$793,868.63, '67, 260; '75, i, 364; '86, 261; '87, 1710. Of this estimate \$30,000 was expended between 1875 and 1879 in clearing the river of obstructions, '86, 1496; '92, 1840.

**Surveys.**

Survey, with a view to lock and dam improvement, ordered by act of August 5, 1886. Made, 1888, under direction of Maj. Allen, '88, 1571, 1574.

**MAPS.**

'88, 1574.

**MISPILLION CREEK, DEL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 300.)

**Appropriations.**

1879-'82 .....	\$13,500
1888.....	3,500, '88, 744.
1892.....	12,000, '92, 954.

Total .....	29,000
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List of appropriations, '88, 744.

**MISPILLION CREEK, DEL.—Continued.****Contracts.**

1888. F. C. Somers, for dredging, at 35 cents per cubic yard, '89, 889.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 90; '89, 105; '90, 96; '91, 122, 132; '92, 122, 131.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1884—'. Reports, '88, 743; '89, 889; '90, 927; '91, 1166; '92, 953, 988, 990.

**ASSISTANT.**

A. Stierle. Report, '92, 989, 991.

**Operations.**

1887-'88. No operations for lack of funds, '88, 743.

1888-'89. 8,646 cubic yards material dredged, '89, 889.

1889-'92. No operations, '90, 927; '91, 1166; '92, 953.

**Projects.**

By Col. Maccomb, 1879, for the formation of a low-water channel from Milford to the bar at the mouth 6 feet deep and 40 feet wide, with repairs to existing pile structures at the mouth so as to prevent littoral sand drift; estimated cost, \$10,000, '79, 467.

By Lieut. Col. Weitzel, 1883, for a 4-foot low-water channel through bar at the mouth; estimated cost, \$55,000, making, together with \$3,500 for completion of former project, \$58,500, '83, 625, 626.

By Mr. W. F. Smith, 1891, for excavation of a channel 150 feet wide and 6 feet deep at mean low water, extending from the outlet of the river in a south-easterly direction to the 6-foot depth in Delaware Bay, the cut to be protected by a wall of the dredged material along its northern side; estimated cost, \$24,000, '92, 991.

**Surveys.**

Survey for a canal to shorten the distance to the bay ordered by act of September 19, 1890. Made, 1891, under direction of Mr. W. F. Smith, '92, 990.

**MISSISSIPPI RIVER.**

The index for this river is arranged under the following titles, namely:

Mississippi River, reservoirs at sources of.  
Mississippi River, above the Falls of St. Anthony.  
Mississippi River, preservation of the Falls of St. Anthony.  
Mississippi River, Meekers Island Lock and Dam.  
Mississippi River, from Saint Paul to Des Moines Rapids.  
Mississippi River, from Des Moines Rapids to the mouth of the Illinois River.  
Mississippi River, between the mouth of the Illinois and Ohio rivers.  
Mississippi River, from the mouth of the Ohio River to the Head of the Passes.  
Mississippi River, at its mouth.  
Mississippi River (Upper), removal of snags and obstructions.  
Mississippi River (Lower), removing snags and wrecks from.  
Mississippi River, water ganges on.  
Mississippi River, gauging at or near Saint Paul.  
Mississippi River, examination at and near the head of Beaver Island.  
Mississippi River, survey between Saint Paul and Saint Anthonys Falls.  
Mississippi River, examination near Reelfoot Lake.  
Mississippi River, examination at Warsaw.  
Mississippi River, examination at and above Clinton.  
Mississippi River, examination at Hamilton.

**MISSISSIPPI RIVER, from headwaters to the mouth.**

NOTE.—From the varying designations given to the geographical limits of the appropriations for the Mississippi River, it has been impracticable to assemble the appropriations under the subheadings of the text found in this volume.

**Appropriations.****RESERVOIRS AT SOURCES OF.**

1879-'87 .....	\$662,500.00
1888.....	12,000.00
1890.....	80,000.00
1892.....	60,000.00

Total .....	814,500.00
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**MISSISSIPPI RIVER, from headwaters to the mouth—Continued.****Appropriations—Continued.****ABOVE THE FALLS OF SAINT ANTHONY.**

1874-'87 .....	\$105,000.00
1888 .....	10,000.00
1890 .....	18,000.00

Total ..... 133,000.00

**AT THE FALLS OF SAINT ANTHONY.**

1872-'92 .....	\$615,000.00
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**AT MEEKERS ISLAND.**

1873 .....	\$25,000.00
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**FROM SAINT PAUL TO DES MOINES RAPIDS.**

1876-'87 .....	\$1,733,100.00
1888 .....	600,000.00
1890 .....	500,000.00

Total ..... 2,833,100.00

**AT DES MOINES RAPIDS.**

1856-'87 .....	\$5,272,200.00
1888 .....	51,250.00
1890 .....	22,000.00

Total ..... 5,345,450.00

**AT ROCK ISLAND RAPIDS.**

1866-'92 .....	\$1,166,650.00
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**AT ROCK ISLAND AND DES MOINES RAPIDS.**

1852 .....	\$100,000.00
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**FROM DES MOINES RAPIDS TO OHIO RIVER.**

1852-'87 .....	\$5,136,000.00
1888 .....	300,000.00
1890 .....	565,000.00

Total ..... 6,001,000.00

**FROM MINNEAPOLIS TO MISSOURI RIVER.**

1892 .....	\$600,000.00
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**FROM MISSOURI RIVER TO OHIO RIVER.**

1892 .....	\$525,000.00
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**FROM OHIO RIVER TO HEAD OF THE PASSES.**

1874-'87 .....	\$10,115,000.00
1888 .....	*2,920,000.00
1890 .....	3,200,000.00
1891 .....	1,000,000.00
1892 .....	*2,627,000.00

Total ..... 19,862,000.00

**MISSISSIPPI COMMISSION, EXPENSES OF.**

1879-'89 .....	\$850,000.00
1890 .....	5,625.00
1891 .....	1,950.00

Total ..... 857,575.00

**AT MOUTH OF MISSISSIPPI RIVER.**

1836-'87 .....	\$8,136,661.53
1888 .....	18,800.00
1889 .....	500,000.00

Total ..... 8,655,461.53

**REMOVAL OF SNAGS, ETC., FROM UPPER RIVER.**

1870-'87 .....	\$382,000.00
1888 .....	25,000.00
1889 .....	25,000.00
1890 .....	25,000.00
1891 .....	25,000.00
1892 .....	25,000.00

Act of August 11, 1888.

Total ..... 507,000.00

\* Includes appropriations at special localities.

**MISSISSIPPI RIVER, from headwaters to the mouth—Continued.****Appropriations—Continued.****REMOVAL OF SNAGS AND WRECKS FROM LOWER RIVER.**

1868-'87 .....	\$336,250.00	} Act of August 11, 1883.
1888 .....	100,000.00	
1890 .....	49,089.17	
1891 .....	92,720.97	
1892 .....	98,250.00	

Total ..... 676,310.14

**SURVEYS FROM PASSES TO HEADWATERS.**

1884-'92 ..... \$180,000.00

**WATER GAUGES.**

1876-'87 ..... \$42,100.00

1888 ..... 9,600.00

1892 ..... 5,100.00

Total ..... 56,800.00

**MISSISSIPPI RIVER.—RESERVOIRS AT SOURCES OF.**

(Continued from Vol. II, p. 301.)

**Appropriations.**

See list of appropriations under the main heading of "Mississippi River."

List of appropriations, '91, 2200.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 202; '89, 235; '90, 211; '91, 268; '92, 257.

**ENGINEERS IN CHARGE.**

Maj. C. J. Allen, 1878-'90. Reports, '88, 1539; '89, 1791.

Maj. W. A. Jones, 1890-'— . Reports, '90, 2080; '91, 2196; '92, 1818.

**Operations.**

1887-'88. Increasing the lift of Pokegama Dam begun, '88, 1540.

1888-'89. Work of increasing the lift in Pokegama Dam completed; repairs to Pine River, Leech Lake, and Winnibigoshish dams, '89, 1792.

1889-'90. Extension and repairs to Winnibigoshish Dam and repairs to Leech Lake Dam, '90, 2082.

1890-'91. Sled road constructed between Leech Lake and Winnibigoshish dams, and log sluice at latter place repaired, '91, 2198.

1891-'92. Construction of dam for Sandy Lake Reservoir in progress, '92, 1819.

**Physical Characteristics.**

Volume of discharge and effect of reservoirs on river, '88, 1541.

**Projects.**

Since 1870 various plans have been proposed for the improvement of the Mississippi River above Lake Pepin by a system of reservoirs at the sources of the Mississippi and its upper principal tributaries by which the flood water could be impounded and subsequently discharged during the season of low water, '70, 285, 287; '75, ii, 441; '79, 1206, 1223.

In 1880, following the appropriation of June 14, 1880, the project of Maj. Allen was adopted providing for the collection of the surplus water during winter, spring, and early summer, and its systematic release during the seasons of low water. The project provided for the construction of 41 reservoir dams upon the head waters of the Mississippi, Saint Croix, Chippewa, and Wisconsin rivers, at an estimated cost, exclusive of land damages, of \$1,809,083.50, '81, 1761, 1763, 1770, 1781, 2748, 2753; '82, 1830; '85, 1749.

Description of dams, '81, 1763; '83, 1456, 1472; '87, 1667, 1678.

The Board of Engineers of 1880 approved of the location and general plan of the dam proposed by Maj. Allen at the outlet of Lake Winnibigoshish, on the Mississippi River, with recommended modifications in dimensions and construction, '81, 1763. Modifications adopted in 1882, '83, 1472, 1474. Effect of dams on low-water stages, '86, 1503; '87, 1669, 1682, 1685, 1687.

Consideration of further extension of system; Board of Engineers, 1887, do not consider that at present the system should be extended to the Saint Croix, Chippewa, and Wisconsin rivers, '87, 1680, 1690, 1692; '90, 2081.

History of the reservoirs proposed and built at the headwaters of the Mississippi, '92, 1824.

**MISSISSIPPI RIVER above the Falls of Saint Anthony.—**  
(EXCEPT RESERVOIRS AT SOURCES OF.)

(Continued from Vol. II, p. 303.)

**Appropriations.**

See list of appropriations under the main heading of "Mississippi River."

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 201; '89, 234; '90, 210; '91, 268; '92, 256.

ENGINEERS IN CHARGE.

Maj. C. J. Allen, 1878-'90. Reports, '88, 1537; '89, 1787.

Maj. W. A. Jones, 1890-'—. Reports, '90, 2077; '91, 2192; '92, 1816.

ASSISTANT.

R. Davenport. Report, '91, 2194.

**Operations.**

1887-'88. No operations, '88, 1537.

1888-'89. 1,524 snags and logs and 60 cubic yards rock removed from the channel, and 8,318 overhanging trees from the banks, '89, 1788.

1889-'90. No operations, '90, 2078.

1890-'91. 554 cubic yards material and 957 cubic yards of bowlders removed from the channel; 168 cords of brush and 696 cubic yards rock used in construction of 1,409 linear feet of wing and training dams, '91, 2193.

1891-'92. 191 snags and 346 leaning trees removed from the channel and banks, '92, 1816.

**Projects.**

By Maj. Farquhar, 1874, for the improvement of the river between Minneapolis and Saint Cloud to a depth of 5 feet by the removal of sand, gravel, and boulder bars, and the construction of wing dams; estimated cost, \$144,667, '75, i, 359; ii, 449, 452; '86, 1483; '87, 1664. The appropriations of \$45,000, made 1874-'76, were expended on this project, '79, 1166; '80, 1572.

Since 1880 operations have been carried on under the project for the improvement of the river between Aiken and Grand Rapids, 165 miles, by the removal of snags, trees, and bowlders, and the construction of wing dams, so as to afford 3 feet depth during low-water stages. The estimated cost for this improvement from Conradia Shoals to Grand Rapids, 252 miles, was \$54,127.50, '75, ii, 450-453; '80, 1573; '86, 1484; '87, 1664.

In 1889 \$18,000 was estimated as required for completion, increasing the estimate to \$63,000, '89, 1789; '90, 2078.

**Surveys.**

MAPS.

Potters Chute, Hales Rapids, Pine Rapids, Crooked Rapids, Batsons Cut, Ox Portage Bar and Rapids, Noyes Rips, Sandy Lake Rapids, Moose Rapids, Island Rapids, Tow Head Rapids, '91, 2195.

**MISSISSIPPI RIVER.—PRESERVATION OF THE FALLS OF SAINT ANTHONY.**

(Continued from Vol. II, p. 304.)

**Appropriations.**

See list of appropriations under the main heading of "Mississippi River."

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 200.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1878-'90. Report, '88, 1536.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1536.

**Projects.**

Previous to the adoption of the project of 1874 \$200,000 had been appropriated and applied toward closing the tunnel between Hennepin and Nicollet islands by timber and masonry bulkheads and the filling of the upper part of the tunnel with clay and puddle, '71, 257, 294; '72, 297; '73, 408, 410; '74, i, 277; '85, 1722.

The project of 1874 provided for the construction of a concrete dike across the river and underneath the limestone ledge, the construction of flooding or rolling dams to protect the upper surface of the ledge, and the construction of a timber apron and wings to prevent the recession of the crest of the falls, '74, i, 284; '76, i, 699; '85, 1722; '86, 255, 1480. The estimated cost was \$419,792, '74, i, 285. Increased in 1876 to \$529,726.31, '76, i, 700; '78, 726. Reduced in 1884 to original estimate, '84, 1596; '86, 1481. The dike was completed in 1876 and remaining works in 1878, '77, 565; '79, 1159, 1165; '86, 255.

In 1879 a log sluice was placed at the westerly side of the apron, '80, 1565; '86, 1480.

In 1888 \$210,000 was estimated as necessary for the completion of the existing project, '88, 210.

**MISSISSIPPI RIVER.—MEEKERS ISLAND LOCK AND DAM.**

(Continued from Vol. II, p. 305.)

**Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

**Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 201.

**ENGINEER IN CHARGE.**

Maj. C. J. Allen, 1878-'90. Report, '88, 1536.

**Operations.**

1887-'88. No operations, '88, 1536.

**Projects.**

By Maj. Warren, 1867, modified in 1874, so as to provide for a lock and dam across the river at Meekers Island; timber dam, with lock of 17-foot lift, with faces of granite masonry; dimensions of lock 300 feet by 80 feet; estimated cost, \$922,121, '67, 259; '74, i, 287; '81, 1747.

**MISSISSIPPI RIVER from Saint Paul to Des Moines Rapids.—(EXCEPT HARBOR OF REFUGE IN LAKE PEPIN, ICE HARBOR AT DUBUQUE, ROCK ISLAND RAPIDS, AND DES MOINES RAPIDS.)**

(Continued from Vol. II, p. 306.)

**Appropriations.**

See list of appropriations under main heading, "Mississippi River."

**Commerce.**

Commercial interests affected by obstructions at Rock Island Rapids, '89, 1762.

**Contracts.**

1889. Patterson Bros., for construction of dams and shore protection, stone at \$1.20 per cubic yard, and brush at 40 cents per cubic yard; A. J. Whitney, for construction of dams and shore protection, at \$1.20 per cubic yard for stone, and 40 cents per cubic yard for brush; A. J. Whitney, for construction of dams and shore protection, at \$1.15 per cubic yard for stone, and 40 cents per cubic yard for brush; A. H. Whitney, for dam and shore-protection construction, at \$1.30 per cubic yard for stone, and 50 cents per yard for brush, '89, 1738.

1890. A. J. Whitney, for dredging, at 17 cents per cubic yard, '91, 2168.

1891. J. Richtman, for construction and repair of dams and shore protection, stone at \$1.20 per cubic yard, and brush at 27 cents per cubic yard, '91, 2153. W. A. Patterson, for construction and repair of dams and shore protection, at 90 cents per cubic yard for rock, and 50 cents per cubic yard for brush, '91, 2153.

1892. J. Richtman, for construction and repair of brush and rock dams and shore protection, at \$1.20 per cubic yard for rock, and 27 cents per cubic yard for brush, '92, 1795. Patterson Bros., for construction and repair of brush and rock dams and shore protection, at 90 cents per cubic yard for rock, and 40 cents per cubic yard for brush, '92, 1801.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 197, 1510; '89, 232, 1750; '90, 208; '91, 265; '92, 255.

**BOARD OF ENGINEERS.**

Convened at Saint Paul, August 25, 1887, by S. O. No. 67, to examine and report upon the test of the "Adams" flume. Report, '88, 1511. (Majs. Allen and Adams and Capt. Marshall.)

Convened at Rock Island, January 16, 1889, by S. O. No. 59, to report upon project for improvement of the river at Rock Island Rapids. Report, '89, 1751. (Col. Poe and Majs. Mackenzie and Marshall.)

**ENGINEER IN CHARGE.**

Maj. A. Mackenzie, 1880-'—. Reports, '88, 1480; '89, 1731; '90, 2033; '91, 2147; '92, 1779.

**ASSISTANTS.**

C. W. Durham. Reports, '88, 1491, 1504; '89, 1739, 1746; '90, 2038, 2059; '91, 2154, 2169; '92, 1787, 1812.

M. Meigs. Reports, '88, 1506; '89, 1745, 1748; '90, 2056; '91, 2165, 2171; '92, 1809, 1813.

**MISSISSIPPI RIVER, from Saint Paul to Des Moines  
Rapids—Continued.**

**Operations.**

- 1887-'88. 89,035 cubic yards rock and 71,766 cubic yards brush used in construction and repair of wing dams and shore protection at Audalusia and Crooked Slough, between Minneiska and Winona, Reads Landing and Minneiska, Sand Prairie and Savannah, Guttenberg and Waupeton, and Homer and Queens Bluff, '88, 1491, 1502. 1,313 cubic yards rock blasted and removed at Rock Island Rapids, and 28,596 cubic yards sand dredged, '88, 1503, 1504. 860 cubic yards rock removed at Drews Prairie and at Crossing below Island 395; repairs to Shokokon dams Nos. 1 and 2; Dam No. 5 built at Vixen Chute, '88, 1507. 9,500 linear feet of shore protection constructed at Island 395, Sauerweins Bend, and at foot of Burlington Island, '88, 1508.
- 1888-'89. 56,498 cubic yards rock and 71,264 cubic yards brush used in revetment, bank protection, and construction of wing dams at Fountain City, West Newton Bar, Island 395, Shokokon Dams, Crooked Slough, and Fort Madison; also between Saint Paul and Prescott, '89, 1739-1748. Buoyage of Rock Island Rapids, '89, 1744. Repairs to breakwater at Lake City and to shore protection at Burlington and Sauerweins Bend, '89, 1744-1746. 460 cubic yards rock blasted and removed, and 1,843 cubic yards rock placed in dam construction at Rock Island Rapids, '89, 1747.
- 1889-'90. 261,625 cubic yards rock and 285,659 cubic yards brush used in construction of wing dams, training walls, and bank protection between Saint Paul and Prescott, Prescott and Lake Pepin, Reads Landing and Fountain City, Guttenberg and Waupeton, Fairport and Muscatine; also at Winona, Crooked Slough, Keithsburg, Pontosuc, and Fort Madison, '90, 2038-2059. Buoyage of Rock Island Rapids, '90, 2049. 2,156 cubic yards rock blasted and removed, and 9 guide piers built at Rock Island Rapids, '90, 2050, 2052. Construction and repair of plant, '90, 2055.
- 1890-'91. Dams 24 and 25 at Pine Bend completed; Dam No. 22 lengthened, '91, 2156. Shore protection of Island No. 13 repaired; dams 44 to 48 constructed at Grey Cloud Landing, '91, 2156. Dams 32 and 33 built at Nininger, and dams 2, 26, 27, 30, and 31 raised, '91, 2157. Dredging through bar opposite Dam No. 10, '91, 2157. Aggregate length of above works, 3,390 feet, consuming 5,074 cubic yards of rock and 12,044 cubic yards of brush, '91, 2158. 1,130 linear feet of wing-dam construction at Read Landing and vicinity of Teepecota Point, '91, 2160. Repairs to dam at head of Pomme de Terre Slough, '91, 2160. 4,985 linear feet of wing dam built and repaired, consuming 11,286 cubic yards of rock and 14,795 cubic yards of brush at Fountain City and Wilds Landing, '91, 2161. Break in dam across Harper Slough repaired, '91, 2162. Buoys reset on Rock Island Rapids, '91, 2162. 1,659 cubic yards of rock blasted and 2,119 cubic yards dredged and removed from Saint Louis Chain, Rock Island Rapids, '91, 2164. Repairs to pier at Lake City, '91, 2165. 14,837 cubic yards of rock and 10,720 cubic yards of brush used in construction of dams and shore protection in vicinity of Burlington and Dallas, '91, 2166. Repair and construction of plant, '91, 2169. 22,370 cubic yards of rock and 20,307 cubic yards of brush used in construction of dams and shore protection at Read Landing, Minneiska, La Crosse, Prairie du Chien, and Clinton, '91, 2170. 9,082 cubic yards of material dredged at Port Byron Harbor, '91, 2170. 11,465 cubic yards of material, 240 cubic yards of boulders, and one wreck removed at Montrose Harbor, '91, 2171.
- 1891-'92. 1,230 cubic yards of rock blasted and removed below Minneapolis, '92, 1788. 2,720 linear feet of bank revetment constructed at Pike Island, '92, 1789. Dredging at Groveland Park, Minnehaha, Pike Island, and above Fort Snelling, '92, 1789. 8,055 linear feet of brush and rock dam built between Saint Paul and Prescott, '92, 1792. 3,120 linear feet of brush and rock dam built between Prescott and Lake Pepin; 20,867 linear feet of brush and stone dam and shore protection built between Reads Landing and Minneiska, '92, 1796. 15,408 linear feet of brush and rock wing dam and shore protection built between Minneiska and La Crosse, '92, 1798. 2,571 linear feet of dam and shore protection built and repaired between La Crosse and Crooked Slough, '92, 1800. 7,019 linear feet of brush and rock wing dam built at Prairie du Chien, '92, 1801. 760 linear feet of wing dam built at Cassville Slough, '92, 1802. 1,350 linear feet of dam and shore protection built in vicinity of Clinton, '92, 1802. 37,094 cubic yards of material dredged at Port Byron Harbor, '92, 1803. 3,390 cubic yards of solid rock blasted and removed, 2,672 cubic yards of stone used in construction of guide piers, and 2,960 linear feet of wing dam built at Rock Island Rapids, '92, 1806. Construction and repair of plant, '92, 1807. 11,069 linear feet of brush and rock dam and revetment constructed between Keithsburg and Montrose, '92, 1811. 11,465 cubic yards of material dredged at Montrose Harbor, '92, 1812. 16,965 cubic yards of material dredged at Pike Island, '92, 1813.



**MISSISSIPPI RIVER, from Saint Paul to Des Moines Rapids—Continued.**

**Plans.**

By Board of Engineers, 1889, for construction of a canal around Rock Island Rapids 10½ miles in length, with a width of from 200 to 500 feet and a low-water depth increasing from 6 to 12 feet, having two locks 80 feet wide and 325 feet long; estimated cost, \$4,000,000, '89, 1750, 1767.

**Projects.**

The general project for the improvement of the river between Saint Paul and Des Moines Rapids is the gradual bringing of the river into one channel by the construction of brush and stone dams by which chutes are closed and wide places contracted; also the protection of caving banks and heads of islands. At special localities dredging is resorted to as an aid to the contracting and regulating works, '81, 2745; '83, 1383.

**AT SPECIAL LOCATIONS.**

At Guttenberg, Iowa, the project was the closure of Swifts Slough and the protection of the head of the island opposite the town, '81, 1694, 1700; '85, 1720.

At Dubuque, Iowa, the project of 1876 proposed the formation of an artificial cut from Waples to New Barneys cuts; also the closure of Seventh Street Slough, New Barneys and Waples cuts, '76, i, 696. Modified in 1877 for temporary improvement of the bar by dredging and subsequently its permanent improvement by the construction of a training dike from the upper end of New Barneys Cut to the railroad bridge, '77, 525.

In 1879 a Board of Engineers recommended the improvement of the bar by the construction of two contracting dikes from the Dunleith Shore if the dredged channel then in progress in front of Dubuque Wharf showed signs of refilling; estimated cost of dikes, \$12,688, '79, 1143; '80, 1532. The success of dredging alone having been demonstrated the construction of dikes has been omitted, '86, 1424.

At Rock Island Harbor the project of 1879 proposed the removal, by dredging, of the bar along the levee and a part of the large bar extending from the foot of Rock Island, covering the steamboat landing; estimated cost, \$26,759.15, '80, 1539; '85, 1695. Project completed in 1884, '85, 1696.

At Andalusia, Ill., the project of 1880 proposed the improvement of the channel of approach between the main channel and the landing by the construction of dams between the Illinois shore and Island 321, between Islands 320 and 321, and between Islands 318 and 319, together with the necessary shore protection; estimated cost, \$18,000, '81, 1705, 1706.

At Muscatine, Iowa, the project of 1879 proposed the temporary improvement of the bar in front of the city landing by dredging; estimated cost, \$19,250, '79, 1137; '80, 1540.

At Burlington Harbor, Iowa, the project of 1875-'79 proposed the improvement of Rush Chute by the removal of the bar at its head by dredging and the contraction of the channel at the foot of the chute by rectifying dams with shore protection; estimated cost, \$69,656.57, '76, i, 691, 693; '79, 1138; '80, 1541. After 1881 this improvement was carried on under appropriations for improving the Mississippi River between Saint Paul and Des Moines Rapids, '81, 1708.

At Fort Madison the project of 1875 proposed the closing of Niota Chute and the protection of the heads of adjacent islands, '76, i, 688; '79, 1139.

In 1889 the Board of Engineers proposed the improvement of the existing navigable channel through Rock Island Rapids, giving a low-water depth of 4 feet, by rock excavation, the construction of wing dams, erection of guide piers, and dredging; estimated cost, \$330,000, '89, 1750, 1761.

**Surveys.****MAPS.**

'89, 1766.

**MISSISSIPPI RIVER from Des Moines Rapids to the mouth of the Illinois River.—(EXCEPT OPERATIONS OF SNAG BOATS.)**

(Continued from Vol. II, p. 309.)

**Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

**Contracts.**

1888. J. Richtman, for brush, at 72 cents per cubic yard, and rock, at \$1.53 per cubic yard, '88, 1463. Price & King, for repairing levees, at 10.9 cents per cubic yard, '89, 1717. A. J. Whitney, for rock, at \$1 to \$1.29 per cubic yard, and brush, from 50 cents to 60 cents per cubic yard, '89, 1719. H. S. Brown, for rock, at \$1.50 per cubic yard, '89, 1720.

**MISSISSIPPI RIVER, from Des Moines Rapids to the mouth of the Illinois River—Continued.****Contracts—Continued.**

1890. M. Von Hein, for repairing barges, at \$3,950; F. Menke, for rock, at 64 cents per cubic yard; Reid, Brose & Ebert, for rock, at 68½ cents per cubic yard; H. L. Hart, for rock, at 54½ cents per cubic yard, and brush, at 29½ cents per cubic yard; Hannibal Lime Company, for rock, at 50 cents per cubic yard; J. G. Fox, for brush, at 35 cents per cubic yard, '91, 2120.
1891. Tighe & McCaffery, for rock, at 69 cents per cubic yard; H. S. Brown, for dredging, at 12.4 cents per cubic yard, '91, 2121.
1892. H. L. Hart, for rock, at from 62 to 66 cents per cubic yard, and brush, at 29½ cents per cubic yard; Reid, Brose & Ebert, for rock, at 69½ cents per cubic yard; Hannibal Lime Company, for rock, at 53 cents per cubic yard; F. W. Menke, for rock, at 62 cents per cubic yard, '92, 1771.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 196, 1466; '89, 230; '90, 206; '91, 263; '92, 253.

**BOARD OF ENGINEERS.**

Convened at Quincy, Ill., October 24, 1887, by S. O. No. 77, to consider and report upon improvement of the Mississippi River from Des Moines Rapids to mouth of Illinois River. Report, '88, 1466. (Lieut. Col. Merrill, Majs. Mackenzie and Miller, and Second Lieut. Craighill.)

Convened at Quincy, Ill., February 18, 1891, by S. O. No. 77, to report upon the reopening of Willows Slough or some other channel from Mississippi River to Quincy Bay. Report, '91, 2131. (Majs. Mackenzie, Miller, and Ruffner.)

**ENGINEERS IN CHARGE.**

Maj. E. H. Ruffner, 1885-'92. Reports, '88, 1461; '89, 1717; '90, 2006; '91, 2119, 2125.

Maj. A. Mackenzie, 1888-'89. Reports, '88, 1479; '92, 1766.

**Operations.****BY HIRED LABOR.**

1887-'88. 4,627 cubic yards rock and 3,762 cubic yards brush placed in dam construction near Cap au Gris; 3,000 cubic yards rock and 1,339 cubic yards brush used in stone protection at Island 500 and at Cap au Gris, '88, 1461. 1,225 linear feet of brush and stone dam built at Martins Landing; 4,686 cubic yards rock and 1,731 cubic yards brush used in revetment at Barrack Island and Island 507; 2,211 cubic yards rock placed in Dardenne Island Dam; 1,583 cubic yards rock used in repair of shore protection at Bottlers Island Tow-head, '88, 1462.

**UNDER CONTRACT.**

2,571 cubic yards of rock and 2,153 cubic yards brush placed in dam and shore protection at Gilbert Island; 1,852 cubic yards rock and 2,097 cubic yards brush used in completion of main dam at Turners Island, '88, 1462. 7,127 cubic yards rock and 5,628 cubic yards brush used at Stag Island Dam; 5,220 cubic yards rock and 2,832 cubic yards brush used in construction of 1,800 linear feet of wing dam above Hannibal, '88, 1463.

**UNDER CONTRACT.**

1888-'89. 245,000 cubic yards material used in repair of levees, '89, 1719. 37,962 cubic yards rock and 23,670 cubic yards brush used in construction and repair of wing dams and shore protection, '89, 1720.

**BY HIRED LABOR.**

19,200 cubic yards gravel dredged and dumped upon Westport Chute Dam; 3,706 cubic yards material dredged from channel above Hamburg Bay, '89, 1721.

**UNDER CONTRACT.**

1889-'90. 24,200 cubic yards rock and 12,108 cubic yards brush used in construction and repair of wing dams and shore protection, '90, 2006.

**BY HIRED LABOR.**

67,568 cubic yards material dredged from bar in front of landing at Hannibal, '90, 2007. Hydraulic dredging at Whitney's Bar, '90, 2008. Extensive repairs to plant, '90, 2010.

**UNDER CONTRACT.**

1890-'91. Repairs to barges, '91, 2120. 34,763 cubic yards material dredged at Cedar Creek Bar, '91, 2121.

**BY HIRED LABOR.**

4,460 linear feet of shore protection laid at Cottonwood Island, consuming 10,496 cubic yards of brush and stone, '91, 2120. 36,203 cubic yards material dredged and dumped upon dam at head of Clarksville Island; 24,313 cubic yards brush and stone bank protection placed at Suy Island Levee; 1,125 linear feet of wing dam built at Cottonwood Island, '91, 2122. Total material, rock and brush, used in wing dams and shore protection, 43,183 cubic yards, '91, 2123.

# **MISSISSIPPI RIVER from Des Moines Rapids to the mouth of the Illinois River—Continued.**

## **Operations—Continued.**

### **UNDER CONTRACT.**

1891-'92. 48,200 cubic yards material dredged in Quincy Bay, '92, 1767.

### **BY HIRED LABOR.**

Dam at Clarksville Island raised and strengthened; repairs to shore protection at Scotts Landing; 2,750 cubic yards rock and 527 cubic yards of brush used in shore protection opposite the foot of Hog-back Island; 1,800 cubic yards rock and 871 cubic yards brush used in wing dam at Hickory Chute; 1,252 cubic yards rock and 1,362 cubic yards brush used in construction of wing dam at Tully Island; 19,542 cubic yards gravel used in shore protection above Hannibal Bridge and at bend of Tully Island, '92, 1767, 1768.

## **Plans.**

In 1891 the Board of Engineers did not consider the "reopening of Willow Slough or some other channel from the Mississippi River to Quincy Bay" advisable, '91, 2132.

## **Projects.**

The general project for the improvement of the river between Des Moines Rapids and the mouth of the Illinois River, a distance of 161 miles, is the closure of side channels by low dams, usually of brush and stone; the contraction of the width of the river, where excessive, by spur dikes of brush and stone, and the protection of banks subject to erosion by brush mattress, covered with stone; the object sought is a low-water depth of about 5 feet, '81, 2745; '85, 2539; '87, 217.

At Alexandria Harbor, Mo., the project of 1879 proposed the improvement to a depth of 5 feet at low water of Warsaw Crossing Bar by the construction of wing dams; estimated cost, \$30,945.75, '79, 1150; '83, 240. Improvement accomplished in 1883 by the expenditure of \$16,000, '83, 1424.

At Quincy Harbor and Bay the project of 1879 proposed the improvement of the bar in front of the city landing by 3 spur dikes and 1 closing dam from the right bank, and the improvement of Quincy for use as an ice harbor, and to accommodate commerce by dredging to a depth of 6 feet; estimated cost, \$224,110, '79, 1130, 1131; '80, 1543.

The project for improvement of the river at Hannibal, Mo., was adopted in 1880 and proposed the removal of the bar in front of the city by dredging and the prevention of its re-formation by spur dikes from the Illinois shore; estimated cost, \$60,000, '80, 1547.

By Maj. Mackenzie, 1880, for improvement of the river in the vicinity of Louisiana, Mo., so as to afford 6 feet at low water, by the construction of a spur dike from the Illinois shore opposite Louisiana, the removal of rocks from the channel below the bridge, the closing of Buffalo Island and Brokau chutes, the construction of a spur dike from the Illinois shore below the bridge, and the shore protection of Buffalo Island; estimated cost, \$55,000, '81, 1723, 1726.

In 1887 the Board of Engineers recommended, pending the preparation of a consecutive plan for the improvement of this portion of the Mississippi River, that operations be continued under existing projects, the general purpose being to secure a low-water channel throughout of an average width of 2,000 feet by construction of works of contraction, closing duplicate channels and island chutes, and revetment of banks, '88, 1469, 1470.

## **Surveys.**

Survey of Willow Slough. Made, 1890, under direction of Maj. Ruffner, '91, 2125.

# **MISSISSIPPI RIVER at Rock Island Rapids.—(See ROCK ISLAND RAPIDS.)**

# **MISSISSIPPI RIVER between the mouths of the Illinois and Ohio Rivers.—(EXCEPT ICE HARBOR AT SAINT LOUIS.)**

(Continued from Vol. II, p. 312.)

## **Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

## **Commerce.**

List of steamers, barges, and scows arriving at Saint Louis for 1888 and 1889, with draft and tonnage, '89, 1698; '90, 1985; '91, 2105; '92, 1733.

**MISSISSIPPI RIVER between the mouths of the Illinois and Ohio Rivers—Continued.****Contracts.**

1888. Glenwood Lime and Quarry Association, for stone, at 47½ cents per cubic yard, '88, 1425. J. Cleary, for piles, at 8 to 10 cents per foot, '88, 1428. W. D. Bangs, for manila rope, at 10.3 cents per pound, and sisal rope, at 9.7 cents per pound, '88, 1428. Grayton Quarry Company, for stone, at 40 cents per cubic yard, '88, 1428. W. D. Bangs, for sisal yarn, at 9.7 cents per pound, '88, 1428. M. M. Buck, for oakum, at 8 cents per pound, '88, 1428. W. L. Fox & Co., for nails, at 2 cents per pound, screw bolts, at 8.7 cents per pound, and iron, at 1.9 cents per pound, '88, 1428. J. J. Hawk, for wire, at 3 cents per pound, '88, 1428.
1889. N. W. Tucker, for piles, at from 5 to 7 cents per foot, '89, 1680. H. E. Coffin, for wire, at 3 cents per pound, and screw bolts, at 2.3 cents per pound, '89, 1680. H. L. Fox & Co., for manila rope, at 13.6 cents per pound, nails, at 1.9 cents per pound, and spike, at 2.6 cents per pound, '89, 1680. Grafton Quarry Company, for stone, at 40 cents per cubic yard, '89, 1680. N. W. Tucker, for brush, at 95 cents, and poles, at \$1.47 per cord, '89, 1681.
1891. F. Duff, for furnishing lumber, at from \$23 to \$51 per M feet, B. M., '91, 2091. J. Cleary, for piles, at from 6 to 8 cents per linear foot; Grafton Quarry Company, for stone, at 45 cents per cubic yard; A. W. Benedict, for rope, at from 11.15 cents to 7.87 cents per pound; J. J. Hawk, for wire, at 3.05 cents per pound; H. E. Coffin, for spike, at 2.55 cents per pound; H. L. Fox & Co., for screw bolts, at 2.29 cents per pound, '91, 2092. H. S. Brown, for construction of extensive dam, at \$38,270; S. S. Holbrook, for construction of 6 barges, at \$3,750 each; S. W. Coffin, for construction of 7 barges, at \$3,795 each, '91, 2093.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 192, 195; '89, 227; '90, 203; '91, 259; '92, 219.

**ENGINEER IN CHARGE.**

Maj. A. M. Miller, 1886—'. Reports, '88, 1422, 1452; '89, 1673; '90, 1961; '91, 2087; '92, 1713.

**ASSISTANTS.**

D. M. Currie. Reports, '88, 1428; '89, 1681; '90, 1969; '91, 2093; '92, 1719.

W. S. Mitchell. Reports, '88, 1436; '89, 1681; '92, 1717.

J. O. Holman. Reports, '88, 1432; '89, 1687; '90, 1971, 1974, 1975; '92, 1723.

C. D. Lamb. Reports, '88, 1433; '89, 1683, 1686; '90, 1972; '91, 2094.

S. S. Van Norman. Reports, '89, 1688; '90, 1976; '91, 2096; '92, 1723.

**Operations.**

1887-'88. 2 hurdles built at Pulltight, '88, 1423. 1,775 linear feet of bank revetment constructed at Jim Smiths, '88, 1424. Repairs to existing hurdles, and 1,620 linear feet of new hurdle built at Sulphur Springs, '88, 1424. 175 snags and 162 leaning trees removed, '88, 1424.

1888-'89. At Horsetail Bar, 450 linear feet of hurdle built at head of Carrolls Island, and repairs to existing hurdle and revetment, '89, 1674. 115,450 square feet brush-matress and stone bank protection placed at Twin Hollows, extending existing revetment 1,750 feet, '89, 1674. 2,775 linear feet of hurdle built at Pulltight, '89, 1675. 1,200 linear feet of hurdle built at Jim Smiths, '89, 1676. Repairs to hurdles at Sulphur Springs, '89, 1676. 7,170 linear feet of hurdle built at Lucas Crossing, '89, 1676.

1889-'90. 2,605 cubic yards stone used in raising 1,100 linear feet of Piasa Dam to 6 feet above low water, '90, 1965. 8,250 square feet of submerged revetment and 63,500 square feet of upper-bank protection placed at Twin Hollows, '90, 1966. 1,260 linear feet of hurdle built at Pulltight, '90, 1966. 53,100 square feet of mattress built and sunk, and 1,390 linear feet of upper-bank protection placed at Jim Smiths, '90, 1967. 4,050 linear feet of hurdle built at Lucas Crossing, '90, 1967.

1890-'91. 2 hurdles located, and 600 linear feet of mattress placed in protection of their shore ends at Rush Tower, '91, 2093. 2 hurdles built at Saint Genevieve, '91, 2093. 9,744 cords of brush procured and piled for use, '91, 2096. Repairs to plant, '91, 2096.

1891-'92. 110 piles, 45,500 cubic yards brush, and 17,422 cubic yards stone used in extension of submerged brush and stone dike at Alton, '92, 1714. Hurdle construction at Rush Tower continued; mattress 4,000 feet long by 120 feet wide constructed and sunk in protection of portion of Calico Island, '92, 1714. Work at Saint Genevieve completed by hurdle construction and pile driving, '92, 1715. Repairs to plant, '92, 1715.

**Physical Characteristics.**

Gauge records, '88, 1441; '89, 1692; '90, 1979. Depth of water upon the bars between Saint Louis and Cairo for 1888, '88, 1442; 1889, '89, 1696; 1890, '90, 1980; 1891, '91, 2102; 1892, '92, 1728.

# **MISSISSIPPI RIVER between the mouths of the Illinois and Ohio Rivers—Continued.**

## **Plans.**

In view of its ultimate inclusion in the general project for improvement of this section of the Mississippi River, Maj. Miller, in 1888, did not recommend any separate improvement at Rush Island Bend and Ivy Landing, Ill., '88, 1452.

## **Projects.**

The object of the improvement of the river from the mouth of the Illinois River to the mouth of the Ohio, a distance of 241 miles, is to obtain a minimum depth at standard low water of 6 feet from the mouth of the Illinois River to Saint Louis, a distance of about 54 miles, and from thence to the mouth of the Ohio, a distance of about 187 miles, a low-water depth of 8 feet. The general plan contemplates making the improvement continuous, beginning at Saint Louis and working downstream, by reducing the river to an approximately uniform width of 2,500 feet. The methods employed are silt-arresting devices, whereby the solid material caught from the river is deposited so as to form new shore lines, which, together with the natural banks of the river, are protected where necessary from caving and erosion by a revetment of brush and stone; the estimated cost of the project was \$16,997,100, '81, 2745; '82, 2763; '83, 1187; '84, 1417; '85, 2861; '87, 213, 1556, 1569; '89, 1673.

Aggregate amount appropriated to June 30, 1890, \$4,129,600. Amount estimated for completion in 1890, \$12,557,500, '90, 1967.

At Alton Harbor, Ill., the project of 1871 proposed closing the chute behind Ellis Island with a brush and stone dam, '71, 318, 320; '72, 361; '73, 443.

Dam completed to height of 10 feet above low water in 1874, '75, i, 447.

In 1881 Maj. Ernst proposed the removal of the shoal in front of Alton Landing by the construction of a deflecting dike from the Missouri shore and above the head of Ellis Island; estimated cost, \$120,000, '81, 1573; '82, 1644.

At Cape Girardeau, Mo., Maj. Ernst proposed, in 1881, the formation of an 8-foot channel between Cape Girardeau and Mintons Point by the construction of hurdle dikes from the end of Devils Island, near Mintons Point, and from the Illinois shore opposite Cape Girardeau; estimated cost, \$90,170.16, '81, 1598; '82, 1650. Plate XX, page 1654.

## **Surveys.**

At Rush Island Bend and Ivy Landing, Ill. Examination ordered by act of August 5, 1886. Made, 1888, under direction of Maj. Miller, '88, 1452.

## **MAPS.**

From Saint Louis Bridge to Foster Island, '88, 1424.

At Horsetail, '88, 1424.

At Twin Hollows, '88, 1424.

From Pulltight to Foster Island, '88, 1424.

From Saint Louis Bridge to Calico Island, '89, 1678.

From Horsetail to Meramec River, '89, 1678.

From Meramec River to Calico Island, '89, 1678; '90, 1966.

From Bissells Point to Calico Island, '90, 1966; '91, 2089.

From Turkey Island to Saint Genevieve, '91, 2089.

# **MISSISSIPPI RIVER from the mouth of the Ohio River to Head of the Passes.—IMPROVEMENT OF.**

## **Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

## **Commerce.**

Registered tonnage plying on the Lower Mississippi, '91, 3576.

Shipments of bulk grain by barges to New Orleans during 1890, '91, 3578.

Statement showing approximate receipts and shipments of freight by river for 1890-'91, '91, 3686, 3718.

## **Contracts.**

1888. Serbian, Wright & Co., for levee construction at Plum Point, at 14½ cents per cubic yard, '88, 2198. T. Sullivan, for levee construction at Plum Point, at 14½ cents per cubic yard, '88, 2198. D. T. Hartnett, for levee construction at White River Front, at 14½ and 15 cents per cubic yard, '88, 2207. J. T. Jefferson, for levee construction at White River Front, at 16 cents per cubic yard, '88, 2207. J. J. Cooney, for levee construction at White River Front, at 19 cents per cubic yard, '88, 2207. R. Moore, for dredging in Vicksburg Harbor, at 18 cents per cubic yard, '88, 2282. W. L. Killebrew, for brush, at \$1.09 per cord, and stone, at \$1.39 per cubic yard, '88, 2283. E. Evans, for willow braces, at 40 cents each,

**MISSISSIPPI RIVER from the mouth of the Ohio River to Head of the Passes—Continued.****Contracts—Continued.**

- and willow stringers, at 87½ cents each, '88, 2283. Purcell & Greace and Arnold & De Garis, for levee construction at Tensas Front, at 25 cents per cubic yard, '88, 2286. Tapper & Fisher, for levee construction at Amos Bayou, at 17 cents per cubic yard, '88, 2287. W. R. Harvey, for levee construction at Panther Forest, at 19 cents per cubic yard, '88, 2287. L. C. Dulany, for levee construction at Leland Second Loop, at 16 cents per cubic yard, '88, 2287. W. R. Harvey, for levee construction at Brooks Break, at 18 cents per cubic yard, '88, 2287. W. R. Harvey, for levee construction at Matthews Bend, at 19 cents per cubic yard, '88, 2287. Andrews Bros., for levee construction at Whiskey Chute, at 28 cents per cubic yard, '88, 2287. McTighe & McKee, for levee construction at Grand Lake, at 22 cents per cubic yard, '88, 2287. Ogden & Jones, for levee construction at Kempe, at 28½ cents per cubic yard, '88, 2304. R. M. White, for levee construction at Deer Park, at 14½ cents per cubic yard, '88, 2304.
1889. S. P. McKelvey, for stone, at 67 cents per cubic yard, '89, 2666. Madison Marine Railroad Company, for construction and delivery of 20 wooden barges, at \$2,625 per barge, '89, 2668. W. O. Flynn & Co., for embankment construction, at 18½ cents per cubic yard; excavation, at 20 cents per cubic yard; grubbing, at \$175 per acre, and filling timber, at \$30 per acre, '89, 2691. D. T. Hartnett, J. K. Jeffries, and Arnold & McDonel, for enlargement and repair of levee below Robinsonville, at 15½ cents per cubic yard, '89, 2691. Flynn & Cook, for levee construction at Webb, at 15 cents per cubic yard, '89, 2691. Fudge & Kearns, for enlargement of Blands Bayou, at 15 cents per cubic yard, '89, 2691. G. Hartweg, for stone, at \$1.95 per ton, '89, 2702. E. Evins, for brush, at \$1.27½ per cord, and poles, at \$1.47½ per cord, '89, 2704. E. Evins, for brush, at \$1.17½ per cord; poles, at \$1.67½ per cord, and stone, at \$1.73½ per cubic yard, '89, 2709. Alabama Dredging and Jetty Company, for dredging at Vicksburg, at 17 cents per cubic yard, '89, 2713. R. Johnson, for levee construction at Duval, at 13 cents per cubic yard, '89, 2714. J. A. Cannon, for levee construction at Greenville, at 13½ cents per cubic yard, '89, 2715. T. Sullivan, for levee construction at Skipworth, at 16½ cents per cubic yard, '89, 2715. Ogden & Jones, for construction of Kempe Levee, at 28½ cents per cubic yard, '89, 2727. J. McGinty, for levee construction at Tensas Parish, at 19 cents per cubic yard, '89, 2728. J. Poitevent, for lumber, at \$10.90 per M feet, B. M., '89, 2731. J. H. Gardner, for poles, at from \$2.75 to \$3 per cord, and brush, at \$1.68 per cord, '89, 2731.
1890. E. Evins, for brush, at \$1.27 per cord, and poles, at \$1.47 per cord, '90, 3242. G. Hartweg, for stone, at \$1.50 per ton, '90, 3242. Bryant & Pickett, for brush, at \$1.05, and poles, at \$1.50 per cord; Harvey & Scott, for levee construction, at 23 to 24 cents per yard, '91, 3618. Hunter & Frey, for brush, at \$1.02, and poles, at \$1.50 per cord, '91, 3619. Harvey & Scott, for levee enlargement, at 22 to 28 cents per cubic yard, '91, 3643. J. M. Whitehill, for levee construction and repair, at from 18½ to 25 cents per cubic yard; A. R. Fudge, for levee construction, at 24½ cents per cubic yard; the Sunnyside Company, for levee construction, at 24½ cents per cubic yard; R. E. Craig, for levee repair, at 17½ to 19 cents per cubic yard, '91, 3644. J. Scott & Son, for levee construction, at 23½ cents per cubic yard, '91, 3644.
1891. Monongahela and Western Dredging Company, for dredging, at 26 cents per cubic yard, '92, 3148. Pardesky & Lyman, for levee construction, at 16.95 cents per cubic yard, '92, 3150. T. Sullivan, for levee enlargement, at 15½ cents per cubic yard, '92, 3150. E. Hely, for stone, at \$1.65 to \$1.75 per cubic yard, '92, 3165. Orgill Bros. & Co., for wire, at from \$2.70 to \$6.88 per pound, '92, 3165. Hartnett & O'Brien, for levee work, at 18 cents per cubic yard; O. Ferguson & Sons, for levee work, at 18.96 cents per cubic yard, '92, 3166. F. M. Ferguson, for levee work, at 16.94 to 18.44 cents per cubic yard, '92, 3166. T. Sullivan, for levee work, at 15½ cents per cubic yard, '92, 3167. Little Rock Granite Company, for stone, at \$1.50 per ton, '92, 3195. Hunter & Frey, for brush, at \$1.10 and \$1.12 per cord, and poles, at \$1.75 per cord, '92, 3195. W. L. Killobrew, for brush, at \$1.33, \$1.43, and \$1.14 per cord, '92, 3195. E. Evins, for brush, at \$1.17, and poles, at \$1.97 per cord, '92, 3195. H. E. Coffin, for wire, at \$2.79 per pound; strand, at \$4.81 per 100 pounds; cable, at \$17.95 and \$18.68 per 100 feet; spikes, at \$2.59 per 100 pounds; staples, at \$2.99 per 100 pounds, and manila rope, at \$9.22 per 100 pounds, '92, 3195. Broderick & Bascom Company, for manila rope, at \$9 per 100 pounds, '92, 3195. J. M. Whitehill, for levee construction, at 25 cents per cubic yard, '92, 3199. B. Talley, for levee construction, at 13½ cents per cubic yard; J. E. Mulcahey and J. M. Sullivan, for levee construction, at 16.20 cents per cubic yard; T. Sullivan, for levee con-

# MISSISSIPPI RIVER from the mouth of the Ohio River to Head of the Passes—Continued.

## Contracts—Continued.

struction, at 18½ cents per cubic yard; T. W. Scott, for levee construction, at 12½ cents per cubic yard; Ware & Donaven, for levee construction, at 13½ cents per cubic yard, '92, 3200. A. A. Arnold & Co., for levee construction, at 16½ cents per cubic yard, '92, 3201. J. A. Ware, for levee construction, at 14 cents per cubic yard, '92, 3201. Cary & Bradburn, for levee construction, at 14.98 cents, 23.79 cents, and 22.98 cents per cubic yard; T. A. Helgason, for levee construction, at 14.74 cents per cubic yard, '92, 3232. J. Scott & Son, for levee construction, at 15½ cents per cubic yard; N. W. Irish, for levee construction, at 14½ cents per cubic yard; Gibson & Deaton, for levee construction, at 15.98 cents and 16.98 cents per cubic yard; Louis Le Saassier, for levee construction, at 16 cents per cubic yard, '92, 3232. Andrews Bros. Construction Company, for levee construction, at 13.44 cents per cubic yard; A. G. Gillespie, for levee construction, at 18½ cents per cubic yard, '92, 3233.

## Engineers.

### CHIEF OF ENGINEERS.

Reports, '88, 306; '89, 365; '90, 330; '91, 422; '92, 396.

### BOARD OF ENGINEERS.

Mississippi River Commission: Report, '88, 2191 (Col. Gillmore, president of the Commission). Reports, '88, 2213; '89, 2593, 2596 (Col. Comstock, Lieut. Col. Suter, Maj. Ernst, and Messrs. Harrod, Taylor, and Ferguson). Report, '90, 3083 (Col. Comstock, Lieut. Col. Suter, Maj. Ernst, and Messrs. Harrod, Taylor, Flad, and Whiting). Report, '91, 3397, 3446 (Col. Comstock, Lieut. Col. Suter, Maj. Ernst, and Messrs. Harrod, Taylor, Flad, and Whiting). Report, '92, 2887 (Col. Comstock, Lieut. Col. Suter, Maj. Ernst, and Messrs. Harrod, Taylor, Flad, and Whiting).

### ENGINEERS IN CHARGE.

Capt. S. S. Leach, 1888-'91. Reports, '88, 2195, 2203; '89, 2663, 2679, 2689; '90, 3196, 3211.

Capt. W. T. Rossell, 1888-'92. Reports, '88, 2262, 2270, 2276, 2292; '89, 2699, 2662; '91, 3663.

Capt. D. C. Kingman, 1888-'91. Reports, '88, 2294; '89, 2720; '90, 3289.

Lieut. J. L. Lusk, secretary Mississippi River Commission, 1888-'—. Report, '88, 2230, 2252.

Capt. C. F. Powell, secretary Mississippi River Commission, 1889-'—. Reports, '89, 2604, 2611, 2665; '90, 3111, 3112, 3137, 3179; '91, 3463, 3465.

Capt. W. Young, 1890. Report, '90, 3228.

Lieut. Col. C. R. Suter, 1891-'—. Reports, '91, 3417, 3444; '92, 2905.

Capt. S. W. Roessler, 1891-'—. Reports, '91, 3580; '92, 2913, 3145.

Capt. C. McD. Townsend, 1891-'—. Reports, '91, 3627; '92, 3170.

Lieut. J. Millis, 1891-'—. Reports, '91, 3665, 3716; '92, 3207.

Capt. C. F. Palfrey, 1892-'—. Report, '92, 2914.

### ASSISTANTS.

H. S. Douglas. Reports, '88, 2305, 2311; '89, 2735; '90, 3316, 3328; '91, 3696, 3720.

W. G. Price. Reports, '88, 2308; '89, 2738; '90, 3336; '91, 3699.

J. A. Ockerson. Reports, '89, 2613; '91, 3473, 3486, 3575; '92, 3110.

L. C. Jones. Report, '90, 3119, 3121, 3129.

C. W. Clark. Report, '90, 3140.

W. Gerig. Report, '90, 3150.

C. M. Winchell. Report, '90, 3181.

A. Hider. Report, '90, 3229, 3256.

H. St. L. Coppée. Reports, '90, 3234, 3241, 3252; '92, 3181.

E. C. Tollinger. Reports, '90, 3266; '91, 3497.

H. Goodrich. Report, '90, 3268.

J. J. Hoopes. Reports, '90, 3276; '91, 3660.

F. P. Spalding. Reports, '90, 3281, 3285; '91, 3526.

W. J. Hardec. Reports, '90, 3340, 3344; '91, 3704.

J. A. Seddon. Reports, '91, 3424; '92, 2907.

W. Gerig. Reports, '91, 3497; '92, 3119.

E. W. Sturtevant. Reports, '91, 3505, 3532; '92, 3163.

L. E. Ritter. Report, '91, 3532.

A. J. Nolty. Reports, '91, 3593, 3601, 3606; '92, 3152.

W. M. Rees. Reports, '91, 3601, 3612; '92, 3161.

W. P. Richards. Report, '91, 3658.

H. B. Richardson. Report, '91, 3662.

W. Garvin. Report, '91, 3708.

C. W. Stewart. Report, '92, 2932.

# MISSISSIPPI RIVER from the mouth of the Ohio River to Head of the Passes—Continued.

## Engineers—Continued.

### ASSISTANTS—Continued.

O. W. Ferguson. Report, '92, 2946, 2954.

J. A. Paige. Report, '92, 3074.

F. B. Maltby. Report, '92, 3105.

A. T. Moore. Report, '92, 3109.

## Operations.

1887-'88. Repairs to plant, '88, 2252. 21,782 cubic yards stone delivered at Greenville and Hopefield Bend, '88, 2253. 7 miles of levee built at White River Front, consuming 376,550 cubic yards earth, '88, 2271, 2272. Banks graded and paved and subaqueous mattress work sunk at Greenville Harbor, '88, 2280. 140,877 cubic yards material dredged in Vicksburg Harbor, and 6,800 linear feet of brush and stone dike built, '88, 2283, 2285. 208,220 cubic yards material used in dike construction between Amos Bayou and Arkansas City, '88, 2287. 213,567 cubic yards material used in dike construction under contract at Leland Second Loop, Brooks Break, Matthews Bend, and Whisky Chute, '88, 2288. Brush and stone bank protection completed at Gouldsboro Bend, '88, 2294. 19,588 linear feet of levee built at Kempe Bend, '88, 2301. 5 crib spur dikes built, and 4 old pile dikes repaired in lower Old River, '88, 2308. Sill No. 1 across the Atchafalaya at Sinns Port completed, '88, 2309.

1888-'89. Repairs to towboat, inspection boat, barges, and general plant, '89, 2666. 39,618 cubic yards stone towed and deposited at Plum Point, Bolivar, Greenville, Columbus, Hickman, and Daniels Point, '89, 2667. Construction of 5 spur dikes begun at Columbus, Ky., '89, 2680. Bank revetment at Hickman completed, '89, 2681. Mattress built and stone revetment constructed at Plum Point, '89, 2681. 4,105 linear feet of brush and stone shore revetment laid at Memphis Reach, '89, 2689. 3,170 linear feet of pile, brush, and stone dike built at Baleshead, '89, 2701. 4,400 linear feet of brush mattress built and sunk, 4,250 linear feet of revetment built, and 10,154 cubic yards stone used at Lake Bolivar Front, '89, 2755. 325,045 cubic yards earth consumed in levee work at Arkansas City, Eunice, Panther Forest, Whisky Chute, Lakeport, Louisiana Line, and near Stirling, '89, 2715. 53,000 cubic yards material dredged from bar in lower Old River, '89, 2724. 24,163 cubic yards material placed in low dam on Sill No. 1, in the Atchafalaya River, '89, 2723. 280,514 cubic yards material placed in the Wilson Lever, '89, 2728. Repairs to New Orleans Harbor plant, '89, 2736. 53,100 square feet brush mattress built and sunk at New Orleans Harbor, '89, 2737. 113,070 cubic yards of crib work built, '89, 2738. 68,500 square feet of mattress and 188,670 cubic feet of crib work placed in Spur No. 1, Greenville Bend, '89, 2738.

1889-'90. 19,131 cubic yards stone towed and delivered at various points, '90, 3185. Repairs to plant, '90, 3185, 3186. Spur-dike construction and bank revetment at Columbus, '90, 3196. Hydraulic grading and construction of subaqueous mattress work at Hickman, '90, 3197. 3,000 linear feet of brush mattress placed in Fletchers Revetment, '90, 3198. Brush mattress built and laid at Plum Point, '90, 3199. Pile dike built at Elmot Island, '90, 3200. Dikes 2, 3, 4, and 5 completed at Memphis Harbor, '90, 3211. Bank protection and dike construction at Helena Harbor, '90, 3213. 6,024 linear feet of brush mattress bank protection placed at Louisiana Bend, '90, 3230. 7,750 cubic yards material dredged at Vicksburg Harbor, '90, 3239. 540-linear feet of willow and stone dike built at Greenville, '90, 3245. Repair and protection of levees from flood of 1890, '90, 3256, 3289, 3317. Hard Times, and Wilson Levee, completed '90, 3289. Dike at Greenville Bend completed, and 1,000 linear feet of spur dike built, '90, 3306. 26,000 tons of rock quarried and Sill and Dam No. 3 completed on Atchafalaya River, '90, 3309.

1890-'91. Brush and stone dike construction at Columbus, '91, 3580. 4,500 linear feet of bank protection laid at lower end of Osceola Bar, '91, 3582. Gaps closed and breaks repaired in Elmot Dike, '91, 3583. Bank revetment at Ashport and Fletcher bents, '91, 3585. 762 linear feet of bank revetment constructed at Hopefield Bend, '91, 3586. Repairs to plant for first and second districts, '91, 3591. Southward extension of Helena Levee in progress, '91, 3593. Closing crevasses and enlarging old levee over a distance of 790,300 feet at Laconia Circle, '91, 3594. 164,000 cubic yards material dredged at Vicksburg Harbor, '91, 3628. 465,573 cubic yards material dredged from canal at Delta Point, '91, 3600. Dike and jetty construction in New Orleans Harbor, '91, 3672. Protection and repair of Point Pleasant, Hard Times, Kempe, and Gibsons Landing levees, '91, 3698. Dredging on lower and upper Old River, '91, 3699, 3700. Levee construction on right and left bank below Red River, '91, 3705.



# MISSISSIPPI RIVER from the mouth of the Ohio River to Head of the Passes—Continued.

## Operations—Continued.

1891-'92. Break repaired in Daniels Point Revetment, '92, 2890. 3,250 linear feet of revetment constructed at Ashport Bend, '92, 2891. Extension of revetment at Fletchers Bend, '92, 2891. Revetment at Osceola Bar extended upstream 1,000 feet, '92, 2892. Two breaks in Hopesfield Bend Revetment at Memphis, aggregating 3,350 feet, repaired, '92, 2893. Helena Levee upon White River Front extended southward 28,338 feet, '92, 2894. Enlargement of existing levee upon Yazoo Front, above Hushpuckana, '92, 2894. Ashbrook Neck Revetment extended 3,800 feet, '92, 2894. 6,600 linear feet of revetment built at Greenville, Miss., '92, 2894. Revetment in Lake Providence Reach extended 5,000 feet, and 224 linear feet of existing revetment repaired, '92, 2895. 315,079 cubic yards material dredged from canal at Vicksburg, '92, 2895. 288,072 cubic yards material used in repairing breaks in levees at Catfish Point, Greenville, Stella, and Shipland, Lower Mississippi levee district, '92, 2896. Extension of Lucca Loop Levee at Tensas Basin completed; levee at Opossum Fork enlarged; loops built at Sunnyside and Cracraft; spur constructed on Leland short line, and enlargement of levee below Lower Boggy Bayou begun; total yardage placed, 270,377 cubic yards, '92, 2896. Levee completed at Henderson, Tensas Basin, '92, 2899. 9,840 linear feet of levee built at Hardscrabble, 11,632 feet at Kempe, and 136 feet at Ferriday Crevasse; total yardage, 399,831 cubic yards, '92, 2900. On right bank, below Red River, the following lengths of levee were built: 600 feet at Nina, 8,021 feet at Highland, 4,743 feet at Mayflower, 3,686 feet at Fortville, 3,400 feet at Evergreen, and 783 feet at Dumboine; total yardage, 435,500 cubic yards, '92, 2900. On left bank, below Red River, the following lengths of levee were constructed: 9,258 feet at Southwood, 1,959 feet at Tessier-Bourgeois, and 1,372 feet at Southport; total yardage, 165,911 cubic yards, '92, 2900.

## Physical Characteristics.

Channel depths and velocities at Plum Point Reach, '88, 2198, 2264.  
Effect of overflow in diminishing the velocity of the Mississippi River, and effect of levees along Yazoo Front on flood heights in 1882 and 1883, '88, 2220.  
Elevations and descriptions of secondary triangulation stations between Cairo, Ill., and Donaldsonville, La., '88, 2232.  
Shoal places in the Mississippi River between Cairo, Ill., and New Orleans, La., '88, 2243.  
Least depths on Lake Providence Reach from 1881 to 1888, '88, 2276.  
Discharge observations at Wilsons Point, '88, 2289.  
Table showing increase and decrease in area and in hydraulic radius cross sections of Morganza Reach, '88, 2303.  
Depth of water on crossings between Cairo and Red River, '89, 2614.  
Highest and lowest water readings, Mississippi River and tributaries, at and below Saint Louis, since 1828, which can be referred to gauges of 1871-1889, '89, 2617.  
Index of Discharge Observations, published in the Annual Report of the Mississippi River Commission to 1888, inclusive, '89, 2632.  
Comparative least channel depths and velocities in various channels of the improved portion of Plum Point Reach, Mississippi River, '89, 2683.  
Length and distribution of front levee lines in the alluvial valley of the Mississippi, '90, 3111.  
Mean widths, depths, and means of maximum depths of 2-mile section of main river from Cairo, Ill., to Head of Passes, '90, 3130.  
Discharge observations at New Madrid, Mo., '90, 3153.  
Discharge observations at Helena, Ark., '90, 3160.  
Discharge observations at Arkansas City, Ark., '90, 3164.  
Discharge observations at Wilsons Point, La., '90, 3173.  
Flood of 1890, '90, 3216, 3255, 3272, 3303.  
Crevasse measurements in vicinity of Arkansas City, '90, 3279.  
Portion of Mississippi River Valley showing overflowed areas, '90, 3288.  
Diagram showing discharge at Arkansas City and Wilsons Point, '90, 3288.  
Profile showing heights of Arkansas, Louisiana, and Missouri levees in 1880 and 1890, '90, 3288.  
Report upon investigation of discharge measurements, '91, 3417.  
Report upon investigation of discharge data of 1884-'85, '91, 3424.  
Effects of crevasses upon gauge readings below Red River during high water of 1890-'91, '91, 3444.  
Effects of outlets on the bed of the river below them, '91, 3465.  
Effect of crevasses on controlling depth of the Mississippi River, '91, 3473.

**MISSISSIPPI RIVER from the mouth of the Ohio River to Head of the Passes--Continued.****Physical Characteristics--Continued.**

Results of discharge observations, Mississippi River, Old River, and Bayou des Glaisses, '91, 3488. At Arkansas City, '91, 3492. At Wilson Point, '91, 3497. At New Madrid, '91, 3497. At Helena, Ark., '91, 3508. At Warrenton, Miss., '91, 3512. At Red River Landing, Old River below Turnbull Island, and Atchafalaya River at Simmesport, '91, 3516. At Carrollton, '91, 3522. At Plum Point Reach, '91, 3534. At Memphis, Tenn., '91, 3535.

Crevasse measurements at and below Arkansas City and in Fourth Mississippi River District, '91, 3543.

High-water marks of 1890 and 1891, Mississippi River, Cairo to Carrollton, '91, 3547. Mississippi River and principal tributaries, except the Missouri, high and low waters referred to present or most recent gauges, '91, 3555.

Changes in the bed of the Mississippi River near the Head of the Passes, '91, 3575. Table showing least channel depths and velocity of the river channels from 1890 to 1891, '91, 3617.

Observations at the Ames Crevasse, '91, 3713.

Report on velocity of flood travel on the Lower Mississippi, '92, 2905.

Report on caving banks from Cairo to Donaldsonville, '92, 3110.

Discharge observations, '92, 3119-3144, 3428, 3429.

**Private and Corporate Work.**

1887-'88. 28,330 linear feet of levee built at Diamond Island Bend Gap by the State of Louisiana and the Fifth Louisiana Levee District, '88, 2312.

1891-'92. 1,896,518 cubic yards material placed in repair of levees in Lower Mississippi District by Lower Mississippi Levee Board; 83,484 cubic yards material used by local levee boards in repair and enlargement of levees at Arkansas City, Luna, Leland, Bellevue Front, and Lucca Loop, '92, 2897.

**Surveys.**

Of Plum Point Reach, '89, 2683.

General survey of the Mississippi River, '90, 3179; '91, 3399; '92, 2946.

**MAPS.**

Memphis, Tenn., '88, 2208.

Plum Point Reach, '88, 2264; '89, 2680; '90, 3210.

Hopefield Bend and Memphis Harbor, '88, 2270; '89, 2698.

Lake Providence Reach, '88, 2278; '89, 2718; '90, 3288.

Greenville Harbor, '88, 2280; '89, 2718; '90, 3288.

Vicksburg Harbor, '88, 2284; '89, 2718; '90, 3288.

New Orleans Harbor, '88, 2294; '89, 2718.

Turnbull Island, '88, 2300.

Red River at the mouth, '88, 2300.

Mississippi at Arkansas City, '89, 2597.

Mississippi at Bolivar, '89, 2718; '90, 3288.

Mississippi at Delta Point, '89, 2718.

Mississippi at Vanclose, '89, 2718.

Regimen of the Mississippi, 1 A to 6 A, '90, 3192.

Columbus City Front, '90, 3210.

Hickman Harbor, '90, 3210.

Photographic reproductions showing process of bank revetment, hydraulic grading, weaving, ballasting and sinking subaqueous mattress, and pumping sand on drift, with details of plant used. Plates 5 to 33, '90, 3210.

Helena Harbor, '90, 3212.

Louisiana Bend, '90, 3288.

Batchelors Bend, '90, 3288.

Greenville Bends, '90, 3288.

Hopefield Bend and Memphis Harbor, '91, 3595.

Map of a portion of the Mississippi Valley, showing area overflowed in 1891, '91, 3650.

Maps of levees in the Lower Mississippi levee district, showing Government enlargement, '91, 3650.

Map showing location of levees in Arkansas and Louisiana, '91, 3650.

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Greenville Harbor, '92, 144.

Louisiana Bend, '92, 145.

Lake Providence Reach, '92, 146.

Junction of Mississippi and Atchafalaya, '92, 148.

New Orleans Harbor, '92, 149, 150, 151.

**MISSISSIPPI RIVER at its mouth.**

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**Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 166; '89, 194; '90, 14, 175; '91, 19, 221; '92, 22, 215.

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1229; '89, 1467; '90, 1725.

Maj. J. B. Quinn, 1891-'— . Reports, '91, 1805; '92, 1469.

**ASSISTANT.**

C. Donovan. Reports, '88, 1230; '89, 1469; '90, 1726; '91, 1807; '92, 1470.

**Operations.**

1887-'88. Repairs to upper dam at Head of Passes; 3 wing dams, aggregating 457 feet, built on west side of pass above Grand Bayou; repairs to inner jetty, '88, 1229.

1888-'89. Repairs to upper dam at Head of Passes; concrete wall over east jetty rebuilt; repairs to inner east and west jetties; 6 wing dams built, '89, 1472, 1473.

1889-'90. Repairs to wing dams in Goat Island Reach; reconstruction of concrete wall on inner east jetty completed; repairs to inner east jetty, '90, 1728.

1890-'91. 257 cords of willows weighted with earth added to West 7-Head Dam; 53 linear feet of western end of upper dam rebuilt; Wing Dam No. 2, in Great Island Reach repaired; crib-work capping on east jetty extended 800 feet; continuous crib built over the outer 353 feet of inner east jetty; crib work built over the outer 618 feet; wing-dam construction and dredging, '91, 1808.

1891-'92. Repairs to upper dam, West 7-Head Dam, and Wing Dam No. 2 in Goat Island Reach; crib-work capping on east jetty continued 281 feet; repairs to inner east and west jetties; eight new wing dams built, and repairs made to old ones, '92, 1471, 1472.

**Physical Characteristics.**

Table of depths and widths of channel through South Pass, '88, 1235.

Dimensions of channel through the jetties for 1888, '88, 1237; '89, 1475.

Minimum depths through the jetties from 1875 to 1890, '90, 1732.

Table giving the depths of water through the jetties at various dates, '92, 1476.

**Projects.**

The projects for the improvement of the mouths of the Mississippi, from 1837 to 1878, inclusive, proposed the formation and maintenance of a channel 18 feet deep through either Southwest Pass or Pass à l'Ouvre by stirring the bottom and by dredging. This method of improvement was discontinued in 1878, when the improvement of South Pass by jetties had attained a depth of 18 feet. Inclusive of surveys, there was appropriated under these projects from 1829 to 1879, inclusive, \$2,541,669.53.

The act of March 3, 1875, authorized James B. Eads to build jetties and other works in South Pass, for the purpose of ultimately obtaining and maintaining a channel 300 feet wide and 30 feet deep over the bar at the mouth of the pass through the pass into the river above.

The acts of June 19, 1878, and March 3, 1879, amended the original act so that James B. Eads was only required to obtain a channel 26 feet deep, 200 feet wide at bottom, and having through it a central depth of 30 feet without regard to width; these channels to be maintained for twenty years from July 8, 1879. For this James B. Eads was to ultimately receive \$5,252,000, and in addition \$100,000 per annum for maintaining this channel.

**Surveys.**

Survey of South Pass from its head to South Pass light-house, '88, 1234; '89, 1473; '90, 1729.

Beyond the ends of the jetties, '88, 1239; '89, 1478; '90, 1730; '91, 1809.

**MAPS.**

Channel between jetties, '88, 1242; '89, 1479; '90, 1735.

Chart of portion of South Pass, showing the location of jetties at its mouth, '91, 1816.

**MISSISSIPPI RIVER, UPPER.**—REMOVAL OF SNAGS AND OBSTRUCTIONS.

(Continued from Vol. II, p. 315.)

**Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

List of appropriations, '88, 1474.

**Commerce.**

List and dimensions of steamers navigating the Upper Mississippi in 1890, '90, 2027.

Lumber interests, '90, 2031.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 196; '89, 231; '90, 207; '91, 264; '92, 253.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1880— Reports, '88, 1471; '89, 1726; '90, 2021; '91, 2137; '92, 1749.

ASSISTANT.

C. W. Durham. Reports, '88, 1474, 1479; '89, 1727; '90, 2029; '91, 2143; '92, 1756.

**Obstructions.**

List of wrecks between Saint Louis and Saint Paul which have been, are, or may become obstructions to navigation, with approximate dates of sinking, '92, 1764.

**Operations.**

1887-'88. 232 snags and 3 wrecks cleared from the channel, and 833 leaning trees cut from the banks, '88, 1475.

1888-'89. 361 snags removed from the channel, and 2,034 trees cleared from the banks; 31,500 cubic yards material dredged from the channel, '89, 1728.

1889-'90. 400 snags removed from the channel; 1,183 cubic yards rock placed in dams; 1,690 leaning trees cleared from the banks; 8 wrecks and 11,160 cubic yards gravel removed, '90, 2030.

1890-'91. 271 snags, 5 cribs, 1 wreck, and 36 dump loads of material removed from the channel, and 2,200 leaning trees cleared from the banks, '91, 2144, 2145.

1891-'92. 359 snags removed from the channel, and 1,265 leaning trees cleared from the banks, '92, 1759.

**MISSISSIPPI RIVER, LOWER.**—REMOVING SNAGS AND WRECKS FROM.

(Continued from Vol. II, p. 316.)

**Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 191; '89, 225; '90, 203; '91, 258; '92, 248.

ENGINEER IN CHARGE.

Maj. A. M. Miller, 1884— Reports, '88, 1419; '89, 1671; '90, 1959; '91, 2079; '92, 1705.

**Operations.**

1887-'88. 798 snags and 348 trees cleared from the channel and banks, '88, 1420.

1888-'89. 1,864 snags, 34 drift piles, and 8 wrecks removed from the channel, and 9,102 trees cleared from the banks, '89, 1672.

1889-'90. 2,861 snags, 23 drift piles, and 1 wreck removed from the channel, and 12,112 trees cleared from the banks, '90, 1960.

1890-'91. 3,450 snags pulled, 21,316 trees cut, and 30 drift piles removed, '92, 1706.

**MISSISSIPPI RIVER.**—WATER GAUGES ON.

(Continued from Vol. II, p. 323.)

**Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

List of appropriations, '88, 1372.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 184; '89, 216; '90, 194; '91, 246; '92, 239.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1886— Reports, '88, 1370; '89, 1624; '90, 1908; '91, 2014; '92, 1663.

**MISSISSIPPI RIVER.—WATER GAUGES ON—Continued.****Physical Characteristics.**

Elevations of gauge zeros from Saint Louis to Carrollton above Cairo datum, '89, 1628.

Comparison of flood of 1890 with highest water previously recorded, '90, 1912.

Chart showing limiting lines of high and low water on the Mississippi from Saint Louis to the Head of the Passes, '91, 2014.

Comparison of flood of 1891 with highest water previously recorded, '91, 2019.

Comparison of flood of 1892 with highest water previously recorded, '92, 1666.

**MISSISSIPPI RIVER.—GAUGING AT OR NEAR SAINT PAUL, MINN.****Appropriations.**

See list of appropriations under the main heading, "Mississippi River."

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '90, 215; '91, 273; '92, 261.

ENGINEER IN CHARGE.

Maj. W. A. Jones, 1890. Reports, '90, 2099; '91, 2214; '92, 1849.

ASSISTANTS.

A. Johnson. Report, '90, 2106.

A. O. Powell. Report, '90, 2107.

**Physical Characteristics.**

Gaugings made at Saint Paul, Minn., during 1890, '90, 2101, 2102; 1891, '91, 2215, 2216; 1892, '92, 1850, 1851.

**MISSISSIPPI RIVER, at and near the head of Beaver Island, Clinton, Iowa.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 234.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1888. Report, '89, 1784.

**Physical Characteristics.**

Description of the locality, '89, 1785.

**Plans.**

In 1888 Maj. Mackenzie did not consider the locality worthy of improvement, '89, 1786.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Mackenzie, '89, 1784.

**MISSISSIPPI RIVER, between Saint Paul and Saint Anthony's Falls, Minn.—SURVEY OF.****Commerce.**

Lumber manufacture from 1870 to 1886, '88, 1562, 1571.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 206.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1886. Report, '88, 1560, 1563.

**Physical Characteristics.**

Description of the locality, '88, 1566.

**Plans.**

By Maj. Allen, 1887, for improvement of the river between the Chicago, Saint Paul, Minneapolis and Omaha Railroad Bridge to the landing below the Washington Avenue Bridge, Minn., by dredging and the construction of works of contraction; estimated cost, \$146,000; or, for a 4-foot low-water navigation between the above points by construction of wing dams, closing dams and revetment, dredging, and construction of two locks and dams; estimated cost, \$2,361,060, '88, 1568-1570.

**Surveys.**

Ordered by act of August 15, 1886. Made, 1887, under direction of Maj. Allen, '88, 1563.

**MISSISSIPPI RIVER.**—EXAMINATION NEAR REELFOOT LAKE FOR RESTRAINING THE FLOW OF WATER INTO SAID LAKE AND ADJOINING LOWLANDS.**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 258.

ENGINEERS IN CHARGE.

Capt. S. W. Roessler, 1891. Report, '91, 2073.

Col. C. B. Comstock, 1891. Report, '91, 2074.

ASSISTANT.

W. M. Rees. Report, '91, 2075.

**Physical Characteristics.**

Description of the locality, '91, 2073, 2075.

**Plans.**

In 1891 Col. Comstock considered that the amount of improvement of the Mississippi at this locality to be secured by the works of restraint proposed by Capt. Roessler, at an estimated cost of \$260,000, would be too small to justify the expenditure, '91, 2074.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Roessler, '91, 2073.

MAPS.

'91, 2074.

**MISSISSIPPI RIVER.**—EXAMINATION FOR REMOVAL OF BAR AT WARSAW, ILL.**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 264, 2134.

ENGINEER IN CHARGE.

Maj. E. H. Ruffner, 1890. Report, '91, 2134.

**Physical Characteristics.**

Description of the locality, '91, 2135.

**Plans.**

In 1890 Maj. Ruffner reported that a removal of the bar at this locality would be detrimental to that portion of the navigable river, '91, 2136.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Ruffner, '91, 2135.

**MISSISSIPPI RIVER at and above Clinton, Iowa.**—SURVEY FOR REMOVAL OF BARS NORTH OF LITTLE ROCK ISLAND.**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 267.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1890. Report, '91, 2187, 2188.

**Physical Characteristics.**

Description of the locality, '91, 2188.

**Plans.**

By Maj. Mackenzie, in 1890, for construction of a closing dam between Little Rock Island and the tow-head to its left, at an estimated cost of \$5,000, '91, 2189.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Mackenzie, '91, 2188.

**MISSISSIPPI RIVER, main slough at Hamilton.**—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 234; '91, 267, 2185.

ENGINEER IN CHARGE.

Maj. A. Mackenzie, 1888-'92. Reports, '89, 1781; '91, 2185.

**MISSISSIPPI RIVER, main slough at Hamilton—Continued.****Plans.**

After examinations in 1888 and 1890, Maj. Mackenzie did not consider the main slough at Hamilton worthy of improvement by the General Government, '89, 1782; '91, 2186.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Mackenzie, '89, 1781.

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Mackenzie, '91, 2186.

**MISSISSIPPI, SAINT CROIX, CHIPPEWA, AND WISCONSIN RIVERS.—SURVEYS FOR RESERVOIRS AT SOURCES OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 240; '90, 215.

**ENGINEERS IN CHARGE.**

Maj. C. J. Allen, 1889-'90. Report, '89, 1809.

Maj. W. A. Jones, 1890-'—. Reports, '90, 2098; '91, 2214; '92, 1849.

**MISSOURI RIVER from the mouth to head waters.**

NOTE.—From the varying designations given to the geographical limits of the appropriations for the Missouri River, it has been impracticable to assemble the appropriations under the subheadings of the text found in this volume.

**Appropriations.****FROM MOUTH TO SIOUX CITY.**

1876-'87 .....	\$2,551,500
1890.....	800,000
1892.....	600,000

Total .....	4,951,500
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**FROM SIOUX CITY TO FORT BENTON.**

1876-'87 .....	\$490,000
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**FROM SIOUX CITY TO GREAT FALLS.**

1890.....	\$300,000
1892.....	150,000

Total .....	450,000
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**FROM MOUTH TO FORT BENTON.**

1878.....	\$180,000
1888.....	1,000,000

Total .....	1,180,000
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**REMOVING SNAGS AND WRECKED.**

1852-'87 .....	\$387,000
1890.....	75,000

Total .....	462,000
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**SURVEY OF MISSOURI RIVER IN MONTANA.**

1892.....	\$2,500
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**MISSOURI RIVER between mouth and Sioux City, Iowa.—IMPROVEMENT OF.****Appropriations.**

See list of appropriations under main heading, "Missouri River."

**Commerce.**

Commerce of the river, '88, 2320; '90, 3370; '91, 3737; '92, 3262.

# MISSOURI RIVER between mouth and Sioux City, Iowa— Continued.

## Engineers.

### CHIEF OF ENGINEERS.

Reports, '88, 307; '89, 365; '90, 331; '91, 423; '92, 397.

### BOARD OF ENGINEERS.

Missouri River Commission. Reports, '88, 2313; '89, 2741; '90, 3361 (Lieut. Col. Suter, Majs. Mackenzie and Ernst, and Messrs. Broatch and Broadhead.) Report, '92, 3251 (Lieut. Col. Suter, Majs. Mackenzie and Ernst, and Messrs. Broadhead and Berlin).

### ENGINEERS IN CHARGE.

Lieut. H. M. Chittenden, 1889-'— Reports, '89, 2760; '90, 3419.

Capt. T. A. Bingham, 1888-'— Reports, '88, 2317; '89, 2753; '90, 3375.

### ASSISTANTS.

J. A. Seddon. Reports, '88, 2355; '91, 3827; '92, 3273.

S. W. Fox. Reports, '88, 2357; '89, 2765; '90, 3428; '91, 3804, 3835; '92, 3278.

S. H. Yonge. Reports, '88, 2359; '89, 2785; '90, 3435; '91, 3805, 3848; '92, 3290.

W. R. De Witt. Report, '89, 2782.

O. B. Wheeler. Reports, '90, 3398; '91, 3756.

G. A. Marr. Reports, '90, 3403; '91, 3745.

C. F. Potter. Reports, '90, 3422, 3427; '91, 3802, 3832, 3833; '92, 3273.

D. W. Wellman. Report, '91, 3807.

A. H. Blaisdell. Reports, '91, 3819; '92, 3271.

Lieut. H. M. Chittenden. Report, '91, 3821.

## Obstructions.

Profiles of bridges over the Missouri River at Bismarck, Atchison, Sioux City, Fort Leavenworth, Blair, Kansas City, Omaha, Randolph, Sibley, Plattsmouth, Glasgow, Nebraska City, Boonville, Rulo, Saint Charles, and Saint Joseph, '88, 2319; '89, 2756.

## Operations.

1887-'88. Construction and repair of plant; 557 cubic yards rock used in completion of revetment in Lower Bon Ton Bend; 3,000 cubic yards rock placed in Elwood revetment; 2,960 linear feet of bank revetment completed at East Bottoms; 4,500 linear feet of bank protected at Little Platte Bend; 20,261 cubic yards rock quarried, and 5,956 cords brush cut; 1,400 linear feet of mattress built in repair of Kaw Bend revetment, '88, 2356-2367.

1888-'89. 4,250 linear feet of pile and brush dike built at Sioux City, '89, 2763. Repair and reconstruction of plant, '89, 2765. 1,825 cubic yards rock used in repair of Bon Ton revetment, '89, 2767. 318,080 square feet of mattress woven at Bon Ton revetment extension, '89, 2767. 136,700 square feet of mattress work woven and placed at Kaw Bend revetment; repair of plant, '89, 2793.

1889-'90. 1,575 snags removed and 1,048 trees cut, '90, 3364. 13,004 linear feet of pile and mattress revetment built at Omaha, '90, 3422. Repairs to plant, '90, 3424. 200 cubic yards rock used in completion of dike construction at Sioux City, '90, 3427. 4,810 linear feet of brush mattress bank protection built at Nebraska City, '90, 3428. 5,153 linear feet of bank graded, and 4,922 linear feet of mattress woven at Rulo, '90, 3431. Repairs to plant at Kansas City Division, '90, 3435. 6,658 linear feet of brush mattress and stone revetment constructed at Bee Creek Bend, '90, 3437. 3,935 linear feet of brush and stone revetment laid at Nigger Bend, '90, 3439. 1,918 linear feet of brush and stone revetment laid at Kaw Point, '90, 3441. Repairs to Harlem and Kansas City dikes, '90, 3442. Repairs to Kaw Bend at East Bottoms revetment, '90, 3441. 1,302 linear feet of pile and brush mattress dike built at Miami, '90, 3445.

1890-'91. Repairs to dikes in vicinity of Sioux City, '91, 3832. Repairs to plant at Omaha, '91, 3834. 940 linear feet of brush and rock bank revetment built at Nebraska City, '91, 3835. Repair of plant at Nebraska City, '91, 3837. Repair and construction of plant at Saint Joseph, '91, 3839. 3,295 linear feet of pile dike built at Saint Joseph, '91, 3841, 3843. 1,240 linear feet of bank revetment completed at Saint Joseph, '91, 3845. 3,500 linear feet of willow curtains woven and placed upon dikes at Atchison, '91, 3847. 700 linear feet of bank revetment built above the Harlem dikes, '91, 3849. 630 linear feet of single and 856 linear feet of double row dike built at Kansas City, '91, 3850. 836 cords of brush and 31,977 linear feet of cotton-wood piling procured, '91, 3851.

1891-'92. 9,220 linear feet of bank revetment constructed in vicinity of Council Bluffs, '92, 3274. Repairs to plant at Nebraska City, '92, 3279. 14,246 linear feet of bank revetment constructed at Belmont Bend, '92, 3280. Repairs to break in Elwood revetment, '92, 3282. 3,000 linear feet of bank revetment constructed at Bon Ton Bend, '92, 3283. Extension and repair of pile dikes in vicinity of Saint Joseph, '92, 3286. Repairs to Little Platte Bend and Kaw



# MISSOURI RIVER between mouth and Sioux City, Iowa— Continued.

## Operations—Continued.

Bend revetments, '92, 3290. 431 linear feet of double row and 993 linear feet of triple-row dike constructed in extension of Kansas City and Harlem dikes, '92, 3293. 1,244 linear feet of single, 3,472 linear feet of double, and 4,760 linear feet of triple-row dike constructed in Group I, First Reach, '92, 3301. 165 feet of double-row dike and 1,400 linear feet of triple-row dike built in Group II, First Reach, '92, 3304. 120 linear feet of double-row dike and 4,001 linear feet of triple-row dike built in Group III, First Reach, '92, 3306. 389 linear feet of double-row dike and 895 linear feet of triple-row dike built in Cedar Island Group, '92, 3309.

## Physical Characteristics.

Dates of ice closings and openings on the Missouri River, 1872-'87, '88, 2325; '90 3392.

Descriptions and elevations of bench marks on the Missouri River, referred to Saint Louis City directrix, May, 1888, '88, 2328; May, 1890, '90, 3393. Slope profiles of Missouri River from Saint Charles to Sioux City, '89, 2756. Report on bearings in the Missouri River Valley, '90, 3375. Rock profiles in the vicinity of Saint Charles, Mo., '90, 3390.

Borings at Saint Charles, Sibley, Randolph Bluff, Kansas City, and Bellefontaine Bluffs, Mo.; Leavenworth, White Cloud, and Quindaro, Kans.; Rulo, Arago, Nebraska City, Plattesburg, Omaha, and Blair, Nebr.; Sioux City, Iowa; Chamberlain, S. Dak.; Bismarck, N. Dak., '90, 3390. Water-gauge readings for 1891, '91, 3819.

Tables showing mean daily stage and discharge of Missouri River from 1879 to 1890, '91, 3822, 3825.

Table showing total annual discharge of Missouri River from 1879 to 1890, '91, 3827. Areas of cross sections in vicinity of dikes constructed in First Reach, '92, 3310.

## Surveys.

Secondary triangulation of the Missouri River, '89, 2753; '90, 3398; '91, 3756; '92, 3259.

Survey from Three Forks, Mont., to Fort Benton, Mont., '91, 3745.

## MAPS.

Missouri River at Saint Joseph, '88, 2358; '89, 2782.

Missouri River at Little Platte Bend, '88, 2368.

Missouri River at East Bottoms, '88, 2368.

Missouri River at Upper Kaw Bend, '88, 2368.

Missouri River at Omaha, Nebr., '89, 2761.

Missouri River at Sioux City, Iowa, '89, 2764.

Views showing cross and main dike construction at Atchison and plant for pile driving and mattress construction, '89, 2778.

Missouri River at Nebraska City, '89, 2782.

Missouri River at Atchison, Kans., '89, 2782.

Views showing dike construction and plant at Kansas City Reach, '89, 2790.

Missouri River at Little Platte Bend, '89, 2794.

Missouri River at Harlem Dikes, '89, 2794.

Missouri River at Upper Kaw Bend, '89, 2794.

Missouri River at Bakers, Fontanelle, and Shonkin bars, Evans Bend, Seigneurs Reach, and Crocondunez, '90, 3420.

Missouri River at Omaha, Nebr., '90, 3426.

Missouri River at Sioux City, Iowa, '90, 3426.

Missouri River at Nebraska City, Nebr., '90, 3428.

Missouri River at Rulo, Nebr., '90, 3430.

Missouri River at Saint Joseph, Mo., '90, 3432.

Missouri River at Atchison, Kans., '90, 3434.

Missouri River at Kansas City, Mo., '90, 3446.

Missouri River at Miami, Mo., '90, 3446.

Sketches of secondary triangulation of Missouri River from Three Forks to Leavenworth, '91, 3802.

Missouri River at Sioux City, '91, 3833.

Missouri River at Nebraska City, '91, 3837.

Missouri River at Rulo, Nebr., '91, 3839.

Missouri River at Saint Joseph, '91, 3839.

Missouri River at Atchison, '91, 3847.

Missouri River at Kansas City, '91, 3852.

'92, Atlas, 158, 161, 166, 168, 170.

**MISSOURI RIVER between Sioux City, Iowa, and Fort Benton, Mont.**—(INCLUDING MISSOURI RIVER ABOVE THE MOUTH OF THE YELLOWSTONE RIVER, AND MISSOURI RIVER AT NIOBRARA, NEBR., VERMILLION, AND YANKTON, S. DAK.)

(Continued from Vol. II, p. 328.)

**Appropriations.\***

See list of appropriations under the main heading, "Missouri River."

**Commerce.**

Commerce of the river for 1887 and 1888, '89, 2761. Commercial importance of the Missouri between Sioux City and Fort Benton, '91, 2243.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 205; '89, 366; '90, 331; '91, 277.

ENGINEERS IN CHARGE.

Maj. C. J. Allen, 1888-'89. Report, '88, 1556.

First Lieut. H. M. Chittenden, 1889-'— . Reports, '89, 2760; '90, 3419.

Missouri River Commission, 1889-'91. Reports, '89, 2743; '90, 3362.

Capt. C. F. Powell, 1890. Report, '91, 2242, 2245, 2248.

Col. O. M. Poe, 1890. Report, '91, 2245, 2249.

**Operations.**

1887-'88. 750 linear feet of brush and gravel dam built, and 1,720 cubic yards gravel dredged at Shonkin Bar; 1,200 linear feet dam built, and 3,774 cubic yards gravel dredged at Crocondunez; 308 linear feet dam built at Rows Ranch, '88, 1556, 1557.

1888-'89. Dam construction at Fontanelle and Bakers bars, '89, 2761.

1889-'90. 23,688 cubic yards material dredged at Bakers and Fontanelle bars, at Evans Bend, Crocondunez, and Seigneurs Reach; 5,647 cubic yards fascines, 889 cubic yards rock, and 8,051 cubic yards gravel used in construction of wing dams, '90, 3420.

**Projects.**

Operations, except at Vermillion, S. Dak., have been confined to that part of the river lying between the mouth of the Yellowstone and Fort Benton, and have consisted in the improvement of the channel at rapids and shoals by the removal of rock and the construction of dams, '78, 695, 700; '79, 1096; '83, 1355; '84, 1542.

At and below Vermillion, S. Dak., the projects have been directed to the rectification of the river by shore protection and permeable dikes, '79, 1079; '82, 1722.

In 1885 the Missouri River Commission recommended that for the present work be mainly confined to the construction of dams and dredging of shoals on "the rocky river" above Carroll; below that point the snag boat should be kept at work and certain experimental dams constructed near Bismarek, '85, 3003.

In 1888, there being no project for improvement of the river below Carroll, except snagging, \$250,000 was estimated as required for completion of the existing project above that point, '88, 1558.

By Capt. Powell, 1891, for improvement of the Missouri from the mouth of the Big Sioux River to the north line of the State of South Dakota by snagging, removal of wrecks and similar obstructions, and rectification of the river at Yankton and at Pierre, S. Dak.; estimated cost, including survey, \$229,486, '91, 2246.

By Capt. Powell, 1891, for improvement of the Missouri between Sioux City and Fort Benton by completion of rock removal below Judith, Mont., annual operation of snag boats, temporary improvement at the worst bars, maintenance of ice harbor at Rock Haven, and rectification of the river at and near Pierre and Yankton, S. Dak.; estimated cost, \$329,497, '91, 2249.

**Surveys.**

MAPS.

Bakers Bar, Evans Bend, Fontanelle Bar, Seigneurs Reach, Crocondunez, and Shonkin Bar, '90, 3420.

**MISSOURI RIVER between Great Falls, Mont., and Sioux City, Iowa.**—IMPROVEMENT OF.

**Appropriations.**

See list of appropriations under the main heading, "Missouri River."

**Contracts.**

1891. T. P. Baker, for charter of tug boat, at \$50 per day, '91, 2234.

\*Allotted by Missouri River Commission from appropriation act of August 11, 1888, '89, 2741.

# **MISSOURI RIVER between Great Falls, Mont., and Sioux City, Iowa—Continued.**

## **Engineers.**

### **CHIEF OF ENGINEERS.**

Reports, '91, 275; '92, 263.

### **ENGINEER IN CHARGE.**

Capt. C. F. Powell, 1891-'— Reports, '91, 2232; '92, 1875.

### **ASSISTANT.**

H. C. Gould. Reports, '91, 2234; '92, 1879.

## **Operations.**

1890-'91. Repairs to dams at Bakers, Evans, and Fontanelle bars; repair and reconstruction of plant, '91, 2233.

1891-'92. Repairs and extension of dams at Bakers Bar, Crocondunez, and three dams of the Fontanelle system; wing dams built at Archers Bar and Norris Island; 31,326 cubic yards material dredged at Archers, Churchills, and Crow Coulees bars; 322 snags and 3 wrecks cleared from the channel, '92, 1876, 1877.

## **Physical Characteristics.**

Description of the river and adjacent country, '92, 1886.

## **Surveys.**

Survey of the Missouri River between Great Falls, Mont., and Sioux City, Iowa, '92, 1886.

# **MISSOURI RIVER from old mouth of Platte River to the city of Leavenworth; also at the city of Weston, Mo.—EXAMINATION OF.**

## **Engineers.**

### **CHIEF OF ENGINEERS.**

Report, '91, 275.

### **ENGINEER IN CHARGE.**

Lieut. Col. C. R. Suter, 1891. Report, '91, 2229.

## **Plans.**

After examination, in 1891, Lieut. Col. Suter did not consider either of the above localities worthy of improvement, '91, 2229.

## **Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Suter, '91, 2229.

### **MAPS.**

'91, 2230.

# **MISSOURI RIVER, MONT.—EXAMINATION BETWEEN GREAT FALLS AND CANYON NEXT BELOW STUBBS FERRY.**

## **Commerce.**

Demands of commerce, '92, 1906.

## **Engineers.**

### **CHIEF OF ENGINEERS.**

Reports, '91, 278; '92, 265.

### **ENGINEER IN CHARGE.**

Capt. C. F. Powell, 1891. Report, '92, 1904, 1908.

### **ASSISTANT.**

Lieut. J. C. Sanford. Report, '92, 1905.

## **Plans.**

By Capt. Powell, 1892, for (1) removal of snags from the "long pool" extending up from Great Falls 51 miles; (2) construction of 2,000 feet of dams and 3,500 feet of bank protection, extending the 3-foot channel 4 miles farther to the towns of Cascade and Saint Clair; (3) construction of 10,000 feet of dams and removal of boulders and rock on the next reach of 70 miles, giving a 24-foot channel at low water; estimated cost, \$115,837, '92, 1903.

## **Surveys.**

Examination made, 1891, under direction of Capt. Powell, '92, 1905.

**MISSOURI RIVER.—REMOVING SNAGS BETWEEN KANSAS CITY AND THE MOUTH.**

(Continued from Vol. II, p. 330.)

**Appropriations.**

See list of appropriations under the main heading, "Missouri River."

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 192; '89, 226.

ENGINEER IN CHARGE.

Maj. A. M. Miller, 1881-'— Reports, '88, 1421; '89, 1673.

**Operations.**

1887-'89. No operations, '88, 1421; '89, 1673.

**MISSOURI RIVER (UPPER)—EXAMINATION FOR ICE HARBOR AT BISMARCK, N. DAK.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 241.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1888. Report, '89, 1810.

**Plans.**

In 1889 Maj. Allen did not consider Bismarck a suitable location for an ice harbor, '89, 1815.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Allen, '89, 1810.

**MOBILE HARBOR, ALA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 330.)

**Appropriations.**

1826-'87 .....	\$1, 379, 830. 60
1888 .....	250, 000. 00, '88, 1196.
1890 .....	350, 000. 00, '90, 1695.
1892 .....	212, 500. 00, '92, 1439.

Total ..... 2, 192, 330. 60

List of appropriations, '89, 1428; '91, 1772.

**Contracts.**

1888. Alabama Dredging and Jetty Company, for dredging, at 9 cents per cubic yard, '89, 1429.

1890. National Dredging Company, for dredging, at 8½ cents per cubic yard, '91, 1773.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 159; '89, 186; '90, 168; '91, 277; '92, 206.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1888-'— Reports, '88, 1193; '89, 1428; '90, 1692; '91, 1771; '92, 1435.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1194.

1888-'89. 1,426,390 cubic yards material dredged, and 26 pile clusters placed; repairs to U. S. steam propeller, '89, 1429.

1889-'90. 886,000 cubic yards material dredged, '90, 1693.

1890-'91. 705,882 cubic yards material dredged, '91, 1773.

1891-'92. 395,691 cubic yards material dredged, '92, 1437.

**Projects.**

The improvement of Mobile Harbor was begun in 1827, the depth of water then being 5½ feet through Choctaw Pass and 8 feet on Dog River Bar, '82, 1246.

No appropriations were made between 1857 and 1870.

The projects of 1871-'72 proposed the formation of a dredged channel 200 feet wide and 13 feet deep through Choctaw Pass and Dog River bars for a distance of 9 miles, '71, 559; '72, 592; '73, 692; '74, i, 891.

**MOBILE HARBOR, ALA.—Continued.****Projects—Continued.**

- From 1870 to 1878, inclusive, \$411,000 was appropriated and applied to this project. In 1878 a survey was directed to be made in order to determine whether the existing channel could be improved to a depth of 22 feet. In March, 1880, it was decided to continue the former improvement by dredging to a depth of 17 feet with a uniform width of 200 feet from the 17-foot curve of the same depth in the lower bay; estimated cost, \$820,000, '88, 1194. Between 1881 and 1888 a total of \$765,000 was expended upon this project, '88, 1196.
- In 1885 a project was submitted by Maj. Damrell for the improvement of Mobile River and Harbor, securing 23 feet depth of water by dredging the channel of 1870, first from 9 feet to 13 feet and then from 13 feet to 17 feet; the channel width to be 280 feet; estimated cost, \$1,980,000, '89, 1429, 1430. The appropriation of \$250,000 in 1888 being made specifically for the furtherance of the project of 1885, the improvement of the harbor was continued in 1888 under that project, '89, 1429.
- In 1891 the cost of completing the 17-foot channel, dredging a channel 280 feet wide and 23 feet deep, removing fill during the progress of the work, and dredging a channel in Mobile River up to Chickasabogue, 280 feet wide and 23 feet deep, was estimated at \$1,443,800, with \$60,000 annually for maintenance, '91, 1773-1775; '92, 1439.

**MOKELUMNE RIVER, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 332.)

**Appropriations.**

1884-'87 .....	\$11, 000
1888 .....	2, 000, '88, 2131.
1892 .....	2, 500, '92, 2652.
Total .....	15, 500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 294; '89, 349; '90, 314; '91, 395, 399; '92, 372.

**ENGINEER IN CHARGE.**

Maj. W. H. Heuer, 1887-'—. Reports, '88, 2131; '89, 2485; '90, 2911; '91, 2986, 3133, 3135; '92, 2651.

**ASSISTANT.**

W. D. Woodbury. Report, '91, 3137.

**Operations.**

1887-'88. No operations for lack of funds, '88, 2131.

1888-'89. 107 snags and 72 overhanging trees cleared from river by hired labor, '89, 2486.

1889-'92. No operations, '90, 2912; '91, 2986; '92, 2651.

**Projects.**

By Lieut. Col. Mendell, 1881, for improvement of river between Bensons Ferry and Snodgrass Slough, a distance of 10 miles, by removal of snags, logs, and similar obstructions, and also excavation of shoals near the mouth of the Cosumnes; estimated cost, \$8,250, '82, 2639. Both forks of the river cleared to head of navigation, at a cost of \$10,960, '88, 2131. Projected improvement completed, '89, 2486.

In 1890 Maj. Heuer proposed the further improvement of the river by closing a canal entering the river, and dredging a sand bar formed at the junction, and also one at North Fork, to 6 feet depth mean low water; also removal of snags and overhanging trees; estimated cost, \$9,100, '91, 3135, 3136; '92, 2651.

**Surveys.**

Ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Heuer, '91, 3135.

**MOLINE CITY HARBOR, ILL.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 234.

**ENGINEER IN CHARGE.**

Maj. A. Mackenzie, 1888. Report, '89, 1777.

**MOLINE CITY HARBOR, ILL.—Continued.****Plans.**

In 1888 Maj. Mackenzie did not consider, in view of the great cost of an improvement at Moline City Harbor, that the locality was worthy of improvement, '89, 1781.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Mackenzie, '89, 1777.

**MONHEGAN ISLAND HARBOR, ME.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 31.

ENGINEER IN CHARGE.

Lieut. Col. J. A. Smith, 1888. Report, '89, 547.

**Physical Characteristics.**

Description of the locality, '89, 548.

**Plans.**

In 1888 Lieut. Col. Smith considered that the expense of an improvement would greatly exceed any probable benefit to local commerce, '89, 548.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Smith, '89, 547.

**MONONGAHELA RIVER, PA. AND W. VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 332.)

**Appropriations.**

1872-'89 .....	\$422,300.00	
1888.....	35,000.00	'88, 1677.
	* 161,733.13	
1890.....	* 162,000.00	'91, 2360.
	* 5,000.00	
1892.....	25,000.00,	'92, 1985.
Total .....	811,033.13	

List of appropriations, '92, 1984.

**Commerce.**

Commercial movement on the Lower Monongahela for the years 1884 to 1891, '92, 1986.

**Contracts.**

1888. Mapel Bros. & Titus, for white-oak timber, at \$39.97 per 1,000 feet, R. M.

1889. C. T. McDonald, for lock and dam construction, at \$38,727; Lambert Bros. & Co., for furnishing operating machinery for Lock No. 8, at \$3,889, '89, 1881.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 215; '89, 251, 254; '90, 226; '91, 290, 291; '92, 278, 279.

ENGINEERS IN CHARGE.

Lieut. Col. W. E. Merrill, 1872-'92. Reports, '88, 1676, 1678; '89, 1879, 1882, 1904; '90, 2190, 2192, 2193; '91, 2355, 2357, 2359, 2360.

Maj. A. Stickney, 1892-'— Report, '92, 1984, 1986, 1989.

ASSISTANTS.

P. J. Schopp. Reports, '88, 1677; '89, 1881, 1884.

P. Golay. Reports, '91, 2358; '92, 1987.

J. W. Arras. Report, '92, 1988.

**Legislation.**

Act of August 11, 1888, authorizing the purchase of Lock and Dam No. 7, '90, 2193.

**Operations.**

1887-'88. River and wing walls completed; 3,791 cubic yards masonry laid; retaining wall and abutment finished, '88, 1678. Operation and care of Lock and Dam No. 9, '88, 1678.

\* For purchase of lock and dam.

**MONONGAHELA RIVER, PA. AND W. VA.—Continued.****Operations—Continued.**

1888-'89. Land wall and lock chamber completed, '89, 1881. Operation and care of Lock and Dam No. 9, '89, 1882.

1889-'90. Lock and Dam No. 8 completed; operation and care of locks and dams Nos. 8 and 9, '90, 2190, 2192.

1890-'91. Two lock keepers' houses built at Lock No. 8, and guiding crib below land wall raised and extended into the bank; operation and care of locks and dams Nos. 8 and 9; purchase of locks and dams Nos. 6 and 7, '91, 2355-2360.

1891-'92. No operations, '92, 1985. Operation and care of locks and dams, '92, 1986.

**Plans.**

By Lieut. Col. Merrill, 1889, for the construction of six locks and dams on the Monongahela River above Morgantown, extending the slack-water navigation to above Fremont; estimated cost, \$1,200,000, '89, 554, 1904.

**Projects.**

The original project by Maj. Merrill in 1872 proposed continuing a 6-foot slack-water navigation from Geneva to Morgantown, a distance of 18½ miles, by the construction on the part of the United States of two locks and dams Nos. 8 and 9, the former at Dunkard Creek, the latter at Hounds Rocks; and the construction on the part of the Monongahela Navigation Company of Lock and Dam No. 7, '73, 504. (See also Index to Reports of Chief of Engineers, Vol. I, p. 346.)

From 1872 to 1886, inclusive, \$397,900 had been appropriated, when the cost to complete was estimated at \$30,376, '86, 1542. Report by Board of Engineers, 1886, upon the commercial value and importance of the works built by the Monongahela Navigation Company, '87, 1802, 1808.

**Surveys.**

Examination of Monongahela River above upper dam, West Virginia, for slack-water navigation between Morgantown and Fremont. Made, 1889, under direction of Lieut. Col. Merrill, '89, 1904.

**MONROE HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 333.)

**Appropriations.**

1835-'87 .....	\$215,515.27
1888.....	5,000.00, '88, 1983.
1890.....	5,000.00, '90, 2755.
1892.....	10,000.00, '92, 2486.

Total ..... 235,515.27

List of appropriations, '92, 2485.

**Commerce.**

Present and prospective increase, '90, 2754.

**Contracts**

1888. Sterling & Cooper, for pier and revetment repairs, at a total of \$2,913.15, '89, 2297.

1889. William St. John & Son, for dredging, at 28 cents per cubic yard, '89, 2296.

1890. W. C. Sterling, for repair of breakwater, at a total of \$4,650, '91, 2827.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 268; '89, 320, 328; '90, 289; '91, 363; '92, 344.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1883-'92. Reports, '88, 1981; '89, 2295; '90, 2753; '91, 2825.

Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2486.

**Operations.**

1887-'88. Repairs made to piers, '88, 1982.

1888-'89. Repairs made to piers and revetment; 7,500 cubic yards material dredged, '89, 2296.

1889-'90. Repairs to piers and revetment, '90, 2751.

1890-'91. Repairs to piers and revetment, '91, 2826.

**Physical Characteristics.**

Description of locality, '89, 2295, 2338.

**Plans.**

By Maj. Overman, 1888, for a channel 100 feet wide and 16 feet deep from the 16-foot curve in the lake to Monroe Dock, with rock excavation and pier and revetment repair; estimated cost, \$123,200, '89, 2339.

**MONROE HARBOR, MICH.—Continued.****Projects.**

The earliest improvement was proposed in 1826 by Capt. T. W. Maurice, and provided for the construction of a breakwater in La Plaisance Bay. Under an aggregate of \$19,713.96 this work was completed in 1835, '80, 2085. (See also Index to Reports of Chief of Engineers, Vol. I, p. 278.)

In 1834 Capt. H. Smith proposed the straightening of Raisin River at its mouth by making a direct connection with Lake Erie, through a sand peninsula, by a canal 4,000 feet long and 100 feet wide, and the protection of the entrance by parallel piers extending to the 10-foot curve in the lake, '80, 2085.

From 1835 to 1882, inclusive, \$213,515.27 had been appropriated, when it was estimated that \$20,000 would be required to complete project, '82, 2379; '86, 327. Increased to \$27,000, '89, 2297.

**Surveys.**

Examination of Monroe Harbor for a 16-foot channel ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Overman, '89, 2338.

**MAPS.**

'91, 2827.

**MOOSE-A-BEC BAR, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 334.)

**Appropriations.**

1881-'87 .....	\$40,000
1888 .....	15,000, '88, 376.
1890 .....	15,000, '90, 429.
1892 .....	15,000, '92, 497.

Total ..... 85,000

List of appropriations, '92, 497.

**Contracts.**

1887. L. E. Lunt, for rock removal, at \$16.20 per cubic yard, '88, 377.

1889. T. Symonds, for dredging, at 30 cents per cubic yard, '89, 507.

1891. Hamilton & Webber, for furnishing and delivering stone in breakwater, at 97 cents per ton, and for beacon, at \$2,670, '91, 573.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 11; '89, 20; '90, 15; '91, 20; '92, 24.

**ENGINEER IN CHARGE.**

Lieut. Col. J. A. Smith, 1886—'. Reports, '88, 376; '89, 506; '90, 428; '91, 572; '92, 497.

**Operations.**

1887-'88. 50 cubic yards rock removed, '88, 376.

1888-'89. No operations, '89, 506.

1889-'90. 63,150 cubic yards material dredged, '90, 429.

1890-'91. 1,651 tons of stone placed in the breakwater, '91, 572.

1891-'92. Breakwater construction in progress, '92, 497.

**Projects.**

By Col. Thom, 1880, for formation of channel through Moose-a-bee Bar, 200 feet wide and 14 feet deep at mean low water, by dredging and rock removal; estimated cost, \$28,000, '80, 362. Increased, 1881, to \$40,000, '82, 489; '85, 465.

Amended in 1888 to provide for a channel 300 feet wide and 14 feet deep, the removal of ledge rock near the western end of the channel to a depth of 16 feet, and the construction of a small breakwater and beacon to check cross currents; estimated cost, \$110,000, making the total estimated cost of the enlarged project, \$150,000, '92, 497.

**MOSQUITO CREEK, S. C., between South Edisto and Ashepoo Rivers.—EXAMINATION AND SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 138.

**ENGINEER IN CHARGE.**

Col. Q. A. Gillmore, 1888. Report, '88, 997, 999

**ASSISTANT.**

Lieut. F. V. Abbot. Report, '88, 1001.



**MOSQUITO CREEK, S. C., between South Edisto and Ashepoo Rivers—Continued.****Physical Characteristics.**

Description of the creek, '88, 997.

**Plans.**

By Col. Gillmore, 1888, for dredging Little Mosquito Creek, and making a cut at Fenwicks Island, both 7 feet deep at mean low water and 90 feet wide at bottom, the object being to connect the South Edisto and the Ashepoo rivers; estimated cost, \$61,600, '88, 1000.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Col. Gillmore, '88, 999.

**MAPS.**

'88, 1003.

**MURDERKILL RIVER, DEL.—SURVEY OF.**

(Continued from Vol. II, p. 336.)

**Appropriations.**

1892..... \$7,000

**Engineers.****CHIEF OF ENGINEERS.**

Report, '92, 131.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1890. Report, '90, 981, 983.

**ASSISTANT.**

A. Stierle. Report, '92, 982, 985.

**Physical Characteristics.**

Description of the locality, '92, 985.

**Plans.**

By W. F. Smith, 1891, for the formation, by dredging, of a channel 7 feet deep at low water from Frederica to the 7-foot curve in Delaware Bay, 80 feet wide down to the mouth, and 150 feet wide at bottom and 250 feet wide at top from the mouth to the 7-foot curve in the bay, the cut at the mouth to be protected by an embankment of the dredged material on either side to a height of 2 feet above high spring tides; estimated cost, \$47,550, '92, 984.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of W. F. Smith, '92, 983.

**MUSCLE SHOALS, TENN.—CANAL AT.**

(See TENNESSEE RIVER.)

**MUSKEGON HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 336.)

**Appropriations.**

1867-'87 .....	\$234,000
1888.....	45,000, '88, 1911.
1890.....	50,000, '90, 2637.
1892.....	75,000, '92, 2337.

Total ..... 404,000

List of appropriations, '92, 2337.

**Contracts.**

1889. Charles Berner, for breakwater construction, at a total of \$25,142, '89, 2183.  
S. Bedford, for pine timber, at \$18 per 1,000 feet, B. M., and for pine piles, at 15 cents per linear foot; Gear & Crawford, for edgings, at \$2 per cord, '89, 2183.  
Chicago and Lamont Stone Company, for stone, at \$8.24 per cord, '89, 2183.  
1890. E. G. Crosby, for drift bolts, at 2½ cents per pound, and edgings, at \$1.50 per cord, '90, 2638.

**MUSKEGON HARBOR, MICH.—Continued.****Contracts—Continued.**

1891. Gaylord & Wing, for reconstruction of outer crib, at \$3,825; E. G. Crosby, for removal and renewal of 320 linear feet of north pier, at \$22,750; E. G. Crosby, for piles, timber, and plank, at 10 cents per linear foot, and \$15 to \$17 per M feet; B. M., '91, 2690.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 255; '89, 299; '90, 269, 2639; '91, 340; '92, 325.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1910.

Maj. W. Ludlow, 1889-'—. Reports, '89, 2181, 2644; '90, 2636; '91, 2689; '92, 2333, 2338.

**Operations.**

1887-'88. Repairs to old north pier completed by hired labor; displaced crib in north detached pier replaced under contract, '88, 1910.

1888-'89. No operations, '89, 2182.

1889-'90. South pier extended 250 linear feet; outer cribs ripped; 292 linear feet north pier and 380 feet of south pier rebuilt; 9,610 cubic yards material dredged, '90, 2637.

1890-'91. 320 linear feet of north pier removed and rebuilt; sunken crib of north pier raised; 5,910 cubic yards of material dredged by hired labor, '91, 2336.

**Projects.**

By Maj. Wheeler, 1866, for extension of harbor piers by crib work to 17-foot curve; estimated cost, \$58,450, '66, iv, 145, 146; '79, 1617. Amended in 1879 to \$168,901.75. Modified in 1880 to increase the width of entrance from 190 to 300 feet by a detached north pier, '86, 1764; '87, 2189. From 1867 to 1884, inclusive, \$221,500 had been appropriated, when it was estimated that \$113,625 would be required to complete the project, '84, 1984.

In 1890, after a further expenditure of \$107,500, \$30,000 was estimated as required for completion, '90, 2637; '91, 2690.

By Maj. Ludlow, 1892, for extension of both piers 800 feet to the 20-foot curve in the lake; excavation of a channel 75 feet wide and 18 feet deep from the lake into the harbor, and bank revetment; estimated cost, \$260,000, '92, 2336.

**Surveys.****MAPS.**

'90, 2644.

**MUSKINGUM RIVER, OHIO.—IMPROVEMENT OF, AND OPERATION OF LOCKS AND DAMS ON.**

(Continued from Vol. II, p. 338.)

**Appropriations.**

1886..... \$20,000  
1888..... 102,000, '88, 217.

Total ..... 122,000

**Contracts.**

1888. E. M. Ayres, for dimension stone, at \$2.69 per cubic yard; Griffith & Wedge Company, for gate anchorages, at \$48 per set; J. W. Dickinson, for Portland cement, at \$2.75 per barrel; J. B. Speed, for natural cement, at \$1.30 per barrel; Griffith & Wedge Company, for 2 hoisting engines, at \$555 and \$1,050; G. S. Wormer, for 1 hoisting engine, at \$700; M. Lautz & Son, for iron drift bolts, at \$1,275.70; J. R. King, for timber, at \$19 per M feet. '88, 1689-1691.

1889. A. J. Jolly & Sons, for lock construction, at \$61,340, '89, 1891. E. B. Henderson & Son, for dimension and backing stone, at \$3.67 per cubic yard, '89, 1899.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 217, 1699; '89, 253, 254; '90, 228; '91, 293; '92, 281, 282.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. E. Merrill, 1886-'92. Reports, '88, 1684, 1701, 1708, 1710; '89, 1890, 1892, 1909; '90, 2200, 2201; '91, 2369.

Maj. A. Stickney, 1892-'—. Report, '92, 1999, 2000.

**ASSISTANTS.**

Lieut. L. H. Beach. Reports, '88, 1691, 1704, 1712; '89, 1900, 1911.

J. E. Carpenter. Report, '88, 1695.

Lieut. C. E. Gillette. Reports, '90, 2208; '91, 2377.

E. Moeser. Report, '92, 1999, 2001.

**MUSKINGUM RIVER, OHIO—Continued.****Operations:**

- 1887-'88. Extensive repairs to dams 1, 2, 4, 5, and 6; Lock No. 9 rebuilt; 420 snags, stumps, and obstructions removed; 156,934 cubic yards material dredged at lock entrance and at Bear Creek, Stones Ripple, and Blue Rock bars, '88, 1684, 1685. Operation and care of locks and dams, '88, 1685.
- 1888-'89. Cofferdam completed, and excavation for foundation begun for new lock at Taylorsville, '89, 1891. Operation and care of locks and dams, '89, 1892.
- 1889-'90. Lock at Taylorsville completed, '90, 2200. Operation and care of locks and dams, '90, 2201, 2208.
- 1890-'91. Work of opening out the channel below Lock No. 9 begun; 7,500 cubic yards material and 1,600 cubic yards rock excavated; operation and care of locks and dams, '91, 2369.
- 1891-'92. 13,443 cubic yards rock and 10,062 cubic yards of earth excavated; repairs to existing works; operation and care of locks and dams, '92, 1999, 2008.

**Physical Characteristics.**

Description of the river between Zanesville and Dresden, '89, 1911.

**Projects.**

- The locks and dams on the Muskingum River ceded to the United States by act of Ohio legislature, '86, 1564. Accepted by the United States by act of August 5, 1886, '86, 1547; '87, 1815, 1817.
- In 1886 Lieut. Col. Merrill considered that \$200,000 would be required to repair the State locks and dams between Zanesville and Marietta, '86, 1553.
- In 1887 a more detailed examination of the works indicated that the locks and dams would require more extensive repairs than anticipated in 1886, '87, 1817, 1820.
- By Lieut. Col. Merrill, 1887, for reconstruction and repair of 10 locks and dams between Marietta and Zanesville, at a cost of \$268,218; also for the construction of a lock to take the place of the lateral canal at Taylorsville, at a cost of \$102,000, '88, 1700, 1701, 1702.
- By Lieut. Col. Merrill, 1889, for securing a slack-water navigation between Zanesville and Dresden by construction of a lock and dam at Ellis, at an estimated cost of \$139,000, '89, 1910, 1911.

**Surveys.**

- Survey between Marietta and Dresden. Made, 1888, under direction of Lieut. Col. Merrill, '89, 1894.
- Examination from Zanesville to Dresden, Ohio, ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Merrill, '89, 1900.

**MAPS.**

'88, 1701.

**MUSKINGUM RIVER, OHIO.—(CONSTRUCTION OF ICE HARBOR AT MOUTH OF.**

(Continued from Vol. II, p. 337.)

**Appropriations.**

1879-'87 .....	\$237, 500
1888 .....	60, 000, '88, 1683.
1890 .....	30, 000, '90, 2199.

Total ..... 327, 500

List of appropriations, '92, 1997.

**Contracts.**

1889. D. M. Wolf, for white-oak timber, at \$32 per 1,000 feet, B. M., '89, 1890.
1891. Griffith & Wedge Company, for lock machinery, at \$2,706.64, '92, 1998.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 216; '89, 252; '90, 227; '91, 293; '92, 281.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. E. Merrill, 1871-'92. Reports, '88, 1683; '89, 1888; '90, 2198; '91, 2367.

Maj. A. Stickney, 1892-'—. Report, '92, 1997, 1998.

**ASSISTANTS.**

W. Weston. Report, '88, 1684.

Lieut. C. E. Gillette. Report, '91, 2368.

E. Moeser. Report, '92, 1997, 1999.

**MUSKINGUM RIVER, OHIO—Continued.****Operations.**

- 1887-'88. 300 linear feet of cofferdam built; 10,700 cubic yards material excavated from lock chamber; 1,474 bearing piles driven and capped for lock floor and walls; 2,150 square feet of lock floor laid, '88, 1684.
- 1888-'89. 250 cubic yards concrete and 300 cubic yards of masonry laid, and quantity of stone cut, '89, 1889.
- 1889-'90. Lock floor and lower miter sills laid, and lock walls partially completed, '90, 2199.
- 1890-'91. River wall completed; land wall in process of construction; miter sills completed and upper gates in position, '91, 2368.
- 1891-'92. Land wall completed; lower gates built and placed in position, and lock machinery completed and placed; 2,287 cubic yards mud removed from lock chamber; lock opened to navigation, '92, 1997. Operation and care of ice-harbor and lock, '92, 1998.

**Projects.**

- By Lieut. Col. Merrill, 1879, for construction of an ice harbor by means of a lock and dam, admitting boats from the Ohio River to the Muskingum; lock 400 feet in length between miter sills, and 56 feet wide; new masonry inlet to mill race; extending dam through present lock, and construction of new dam bridge; also dredging below lock; estimated cost, \$216,400, '79, 1365; '80, 1790; '83, 265. Increased, 1883, to \$246,000, '83, 265, 1557. Increased, 1885, to \$296,000, '85, 1821. In 1889 \$15,000 was estimated as required for completion, '89, 1890.

**MYSTIC RIVER, CONN.—IMPROVEMENT OF.****Appropriations.**

1890.....	\$10,000, '91, 741.
1892.....	10,000, '92, 651.
Total .....	20,000

**Contracts.**

1891. Hartford Dredging Company, for dredging, at 14.7 cents per cubic yard, '91, 741.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 70; '91, 47, 63; '92, 67.

**ENGINEERS IN CHARGE.**

Col. D. C. Houston, 1888-'92. Reports, '89, 746; '91, 740; '92, 650.

Lieut. Col. S. M. Mansfield, 1891-'— Report, '91, 672.

**ASSISTANTS.**

H. N. Babcock. Report, '89, 747.

T. T. Hunter Harwood. Report, '91, 675.

**Operations.**

- 1890-'91. 10,821 cubic yards material dredged, '91, 741.
- 1891-'92. 49,179 cubic yards material dredged, '92, 651.

**Physical Characteristics.**

Description of the locality, '91, 672.

**Plans.**

- By Col. Houston, 1888, for cutting of five bends in the stream, and deepening the channel so as to make 15 feet at mean low water up to the highway bridge; estimated cost, \$30,000, '89, 747.

**Projects.**

- By Lieut. Col. Mansfield, 1891, for improvement of the Mystic River from the Boston and Maine Railroad Bridge to the head of navigation by widening and deepening the natural channel of the river to 100 feet width and 6 feet depth at mean low water to the first turn above Dennings Wharf, and thence to the head of navigation 4 feet deep, with the width gradually reduced to 50 feet at Cradock Bridge; estimated cost, \$30,000, '91, 674, 675, 740.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Col. Houston.

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Col. Mansfield, '91, 674.

**MAPS.**

'91, 674.

**NANDUA CREEK, VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 146, 1283.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1891. Report, '91, 1284.

**Physical Characteristics.**

Description of the locality, '91, 1284.

**Plans.**

In 1891 Lieut. Col. Hains did not consider the locality worthy of improvement, '91, 1284.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Hains, '91, 1284.

**NANSEMOND RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 339.)

**Appropriations.**

1873-'79 .....	\$37,000
1888 .....	10,000, '88, 98.
1890 .....	10,000, '90, 1024.
1892 .....	10,000, '92, 1091.

Total ..... 67,000

List of appropriations, '92, 1091.

**Contracts.**

1889. C. Bliven, for dike repair, at a total of \$2,940, '89, 950. C. T. Caler, for dredging, at 29½ cents per cubic yard, '89, 951.

1891. Alabama Dredging and Jetty Company, for dredging, at 20 cents per cubic yard, '91, 1299.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 98; '89, 117; '90, 106; '91, 148; '92, 150.

ENGINEERS IN CHARGE.

Lieut. G. J. Fiebeger, 1888-'92. Reports, '89, 950; '90, 1024; '91, 1298.

Lieut. E. Burr, 1892-'— . Report, '92, 1090.

**Operations.**

1887-'88. No operations, '88, 98.

1888-'89. Dike repair completed under contract, and snags removed from the channel by hired labor, '89, 950.

1889-'90. 16,150 cubic yards material and 28 sawlogs removed from the channel, '90, 1024.

1890-'92. No operations, '91, 1298; '92, 1091.

**Projects.**

By Maj. Craighill, 1872, for a channel 100 feet by 8 feet to be secured by removal of obstructions, dredging, and dike construction; estimated cost, \$20,000, '72, 723. Increased by S. T. Abert, U. S. agent, in 1878, to \$37,000, '78, 541. Completed in 1880, '80, 820.

By Capt. Hinman, 1887, for excavation of a channel, by dredging, 100 feet wide and 12 feet deep at mean low water from head of navigation to mouth of Western Branch, including a turning basin at Suffolk Bridge 200 feet square; spur-dam and training-wall construction; also for a channel of same length and from 200 to 400 feet wide from Town Point to Western Branch by dredging and training-wall construction; estimated cost, \$152,500, '87, 1001; '88, 98.

**NANTICOKE RIVER, DEL. AND MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 339.)

**Appropriations.**

1886-'87 .....	\$10,000
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**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 94; '89, 112; '91, 131.

**NANTICOKE RIVER, DEL. AND MD.—Continued.****Engineers—Continued.****ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1887-'—. Reports, '88, 749; '89, 916; '91, 1204.

**ASSISTANT.**

A. Stierle. Reports, '89, 917; '91, 1205.

**Operations.**

1887-'88. 61,747 cubic yards material dredged from channel and turning basin, '88, 749.

1888-'91. No operations, '89, 916; '91, 1205.

**Plans.**

By W. F. Smith, 1888 for excavation of a channel 8 feet deep at mean low tide and 60 feet wide from Seaford to Concord, Del.; estimated cost, \$10,000, '89, 916.

In 1891 Mr. Smith did not consider the northwest fork of the river worthy of improvement by the General Government, '91, 1205.

**Private and Corporate Work.**

\$12,500 expended in 1888 by the citizens of Laurel in wharf construction and dredging in front of same, '88, 750.

**Projects.**

Lieut. Col. Craighill considers that as there is not less than 8 feet at low water in the main river from the forks to Seaford no improvement is at present necessary, '80, 742. The appropriation of August 5, 1886, was to be applied to extending the 5-foot low-water navigation to Laurel, '87, 842.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Mr. W. F. Smith, '91, 1205.

**NANTUCKET HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 340.)

**Appropriations.**

1828-'87 .....	\$170,834.75
1888 .....	20,000.00, '88, 487.
1890 .....	25,000.00, '90, 555.
1892 .....	25,000.00, '92, 602.

Total ..... 240,834.75

List of appropriations, '92, 600.

**Contracts.**

1889. James Scully, for furnishing and placing riprap granite, at \$2.40 per ton, '89 610.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 33; '89, 45; '90, 39; '91, 48; '92, 53.

**ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1877-'92. Reports, '88, 486; '89, 608; '90, 554; '91, 696.

Capt. W. H. Bixby, 1892-'—. Report, '92, 600.

**Operations.**

1887-'88. 2,941 tons of stone placed in the east jetty, fully completing 385 feet of the same and partially completing an additional 200 feet, '88, 487.

1888-'89. 673 tons stone placed in east jetty, '89, 609.

1889-'90. 6,055 tons stone placed in east jetty, '90, 554.

1890-'91. Extension of east jetty continued by hired labor, '91, 697.

1891-'92. 7,146 tons of stone placed in east jetty, '92, 601.

**Projects.**

Between 1828 and 1832 \$45,834.75 was appropriated, which was expended in ineffectual dredging, '75, ii, 376; '80, 435.

In 1880 Lieut. Col. Warren proposed the formation of a harbor of refuge by the extension of a west jetty of random stone about 4,000 feet long from near Bug Light on Brant Point. Should a second or east jetty be required it should extend from Contue Beach. Estimated cost of western jetty, \$112,000; for both jetties, \$224,000. Estimate of Board of Engineers, \$238,000, '80, 433; '81, 543; '82, 549.

Recommended by Board of Engineers, 1880, '81, 542, 545. Concurred in by the Chief of Engineers, '81, 542.

**NANTUCKET HARBOR, MASS.—Continued.****Projects—Continued.**

In 1885, the western jetty having been nearly completed to its proposed length, the question of the location of the east jetty was submitted to the Board of Engineers, which recommended the curvature to the westward of the further extension of the west jetty; the construction of the east jetty parallel to the west jetty at its outer end and distant about 1,000 feet therefrom, thence connecting by a curve with the outer beach, recourse to be had to dredging where the scour does not result in a channel depth of 15 feet, '85, 576, 579.

Amount appropriated from 1880 to 1886, inclusive, \$125,000; estimated cost for completion of project, \$250,000, '86, 169; '87, 536; '92, 600.

**NAPA RIVER, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 341.)

**Appropriations.**

1888.....	\$7,500, '88, 290.
1890.....	10,000, '90, 2886.
Total .....	17,500

**Contracts.**

1888. San Francisco Bridge Company, for removal of snags and gravel, at a total of \$3,900, '89, 2168.

1891. T. H. Williams, for dredging and snag removal, at a total of \$8,035, '91, 2952.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 290; '89, 344; '90, 309; '91, 389; '92, 367.

**ENGINEERS IN CHARGE.**

Maj. W. H. H. Benyaard, 1889-'—. Reports, '89, 2467; '91, 2952; '92, 2622.

Col. G. H. Mendell, 1890-'—. Report, '90, 2885.

**Operations.**

1887-'88. No operations, '88, 290.

1888-'89. 116 snags and stumps, 458 cubic yards rock, and 7 bowlders removed under contract, '89, 2468.

1889-'90. No operations, '90, 2886.

1890-'91. 729 cubic yards material dredged, '91, 2952.

1891-'92. 21,972 cubic yards material and 32 snags removed, '92, 2622.

**Projects.**

By Col. Mendell, 1885, for the formation, by dredging and removal of obstructions, of a channel 4 feet deep and 75 feet wide from the mouth of the river to Napa City; estimated cost, \$27,600, '85, 2346; '88, 290. Project completed in 1892, at a cost of \$17,500, '92, 2622.

**NARRAGANSETT BAY CHANNEL, R. I.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 62, 733.

**ENGINEER IN CHARGE.**

Maj. W. R. Livermore, 1890. Report, '91, 734.

**Physical Characteristics.**

Description of the locality, '91, 734.

**Plans.**

Maj. Livermore did not consider the locality worthy of improvement, '91, 734.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Livermore, '91, 734.

**NARRAGANSETT BAY at the mouth of Narrow River.—**  
SURVEY OF.**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 56; '90, 51.

ENGINEER IN CHARGE.

Maj. W. R. Livermore, 1888. Report, '90, 595.

**Physical Characteristics.**

Description of the locality, '90, 597.

**Plans.**

By Maj. Livermore, 1889, for construction of a riprap granite breakwater at the mouth of Narrow River, at an estimated cost of \$24,000, '90, 597.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Livermore, '90, 596.

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**NARRAGANSETT BAY, R. I.—(See PROVIDENCE RIVER.)**

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**NARRAGANSETT BAY (LITTLE), R. I. AND CONN.—IMPROVE-**  
MENT OF.

(Continued from Vol. II, p. 341.)

**Appropriations.**

1876-'82 ..... \$36,000

**Engineers.**

ENGINEER IN CHARGE.

Maj. W. R. Livermore, 1887-'88. Report, '88, 508.

**Operations.**

1887-'88. No operations; project completed, '88, 508.

**Physical Characteristics.**

Description of locality, '88, 508.

**Projects.**

By Maj. Warren, 1876, for excavation of channel 200 feet wide and 7½ feet deep at mean low water, extending across the north shore of the bay from Pawcatuck Point to deep water near the mouth of the bay at Sandy Point; also removal of dangerous rocks in channel near Rhodes Folly and Watch Hill; estimated cost, \$51,000, '76, i, 221; '80, 392; '86, 78.

Project completed in 1884, '86, 78, 614; '87, 561.

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**NARRAGUAGUS RIVER, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 342.)

**Appropriations.**

1871-'87 ..... \$32,000

1888 ..... 10,000, '88, 379.

1890 ..... 7,500, '90, 430.

1892 ..... 7,500, '92, 499.

Total ..... 57,000

List of appropriations, '92, 498.

**Contracts.**

1889. A. R. Wright, for dredging, at 20 cents per cubic yard, '89, 509.

1890. Moore &amp; Wright, for dredging, at from 8½ to 22 cents per cubic yard, '91, 576.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 12; '89, 20; '90, 16; '91, 21; '92, 25.

ENGINEERS IN CHARGE.

Lieut. Col. J. E. Smith, 1887-'92. Reports, '88, 378; '89, 508; '90, 429; '91, 574

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 498.



**NARRAGUAGUS RIVER, ME.—Continued.****Operations.**

1887-'88. 55,450 cubic yards material dredged, '88, 378.

1888-'89. No operations, '89, 508.

1889-'90. 44,988 cubic yards material dredged, '90, 430.

1890-'91. 61,752 cubic yards material dredged, '91, 575.

1891-'92. No operations, '92, 499.

**Projects.**

By Col. Thom, 1880, for dredging a channel 200 feet wide and 11 feet deep at low water from deep water off Turners Point to deep water off Ficketts Point; estimated cost, \$50,000, '81, 535.

The first expenditure for this improvement, \$10,000, was made in 1888, '88, 376.

The project for improvement adopted in 1886 consists in dredging a channel 11 feet deep at low water to the steamboat landing at Long Point, and thence 9 feet deep to the "Deep Hole," or anchorage; channel width to be 200 feet throughout, except in the reach by the steamboat wharf, where it is to be increased to 300 feet, '89, 20. Amount required for completion in 1889, \$30,000, '89, 508; '92, 499.

**Surveys.**

MAPS.

'91, 575.

**NASEL RIVER, WASH.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 411.

ENGINEER IN CHARGE.

Capt. T. W. Symons, 1890. Report, '91, 3294, 3296.

ASSISTANTS.

R. A. Habersham. Report, '91, 3295.

A. J. McMillan. Report, '91, 3296.

**Physical Characteristics.**

Description of the locality, '91, 3296.

**Plans.**

By Capt. Symons, 1891, for improvement of navigation by removal of snags and rock, at an estimated cost of \$1,500, '91, 3296.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '91, 3296.

MAPS.

'91, 3296.

**NASSAWADDOX RIVER, VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 112.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1888. Report, '89, 915.

ASSISTANT.

A. Stierle. Report, '89, 915.

**Physical Characteristics.**

Description of the locality, '89, 915.

**Plans.**

In 1889 Col. Craighill did not consider the river worthy of improvement, '89, 915.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of W. F. Smith, '89, 915.

**NATCHEZ, MISS.—(See MISSISSIPPI RIVER BETWEEN MOUTH OF THE OHIO AND HEAD OF THE PASSES.)**

**NEABSCO CREEK, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 343.)

**Appropriations.**

1881..... \$5,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 108.

ENGINEER IN CHARGE.

S. T. Abert, U. S. agent, 1880-'— Report, '88, 814.

**Operations.**

1887-'88. No operations, '88, 815.

**Projects.**

By S. T. Abert, 1881, for excavation of channel 100 feet wide and 7 feet deep from the 7-foot curve in the Potomac River to Atkinsons Upper Landing, a distance of 14,800 feet, including a channel to Atkinsons Lower Landing and Willis Wharf; estimated cost, \$55,924, '81, 948.

**NEBRASKA CITY, NEBR.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****NECHES RIVER, TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 343.)

**Appropriations.**

1878-'84..... \$33,000

List of appropriations, '88, 1260.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 200; '90, 181; '91, 228; '92, 222.

ENGINEERS IN CHARGE.

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1260; '89, 1495; '90, 1753.

Maj. J. B. Quinn, 1891-'— Reports, '91, 1836; '92, 1511.

**Operations.**

1887-'88. No operations, '88, 1261.

1888-'89. 55,812 cubic yards material dredged by hired labor, '89, 1495.

1889-'92. No operations, '90, 1753; '91, 1837; '92, 1512.

**Projects.**

By Capt. C. W. Howell, 1878, for dredging a channel 40 feet wide and 5 feet deep at mean low water across the bar at the mouth of the Neches River; estimated cost, \$26,318, '78, 84; '80, 1202.

By Maj. Mansfield, 1880, for removal of snags, trees, and similar obstructions from Yellow Bluff to Bevilport, a distance of 7 miles; estimated cost, \$15,000, '80, 1204.

Aggregate estimates for projects of 1878-'80, \$41,318, '87, 1384.

**NEHALEM BAY AND BAR, OREG.—SURVEY OF.****Appropriations.**

1890..... \$10,000, '91, 3205.

**Commerce.**

Extensive timber lands, '90, 2995.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 358; '90, 324; '91, 405; '92, 380.

ENGINEERS IN CHARGE.

Capt. W. Young, 1888. Report, '90, 2993, 2995.

Capt. T. W. Symons, 1891. Reports, '91, 3205; '92, 2703.

ASSISTANTS.

J. S. Polhemus. Report, '90, 2993.

G. A. Lyall. Report, '90, 2998.

**Physical Characteristics.**

Description of the locality, '90, 2994.

**NEHALEM BAY AND BAR, OREG.—Continued.****Plans.**

By Capt. Young, 1889, for improvement of the bar at the entrance to Nehalem Bay by construction of two high-tide converging shore jetties, each 3,350 feet in length, with a least distance apart of 500 feet; also for improvement of the channel opposite Lazarus Island at the head of the bay by snagging and dam construction; total estimated cost, \$331,927, '90, 2998.

In 1892 Capt. Symons estimated the cost of jetty construction, north location, north jetty 4,200 feet in length and south jetty 4,500 in length, at \$806,700; for jetty construction, south location, north jetty 6,800 feet in length and south jetty 2,700 feet in length, at \$761,860, '92, 2707.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Young, '90, 2995; '92, 2704.

**NEUSE RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 345.)

**Appropriations.**

1878-'87 .....	\$237, 500
1888 .....	15, 000, '88, 868.
1890 .....	20, 000, '90, 1125.
1892 .....	15, 000, '92, 1131.
Total .....	287, 500

**Commerce.**

Development of, under improved transportation facilities, '88, 870; '89, 1057.

Decrease in freight and transportation charges, '89, 1060.

List of steamers navigating the river in 1892, '92, 1134.

**Contracts.**

1888. B. W. Canady, for timber and iron, '88, 869.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 119; '89, 138; '90, 124; '91, 159; '92, 160.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 866; '89, 1056; '90, 1122; '91, 1358.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1129.

**ASSISTANTS.**

R. Ransom. Reports, '88, 869; '89, 1059; '90, 1125; '91, 1361.

W. H. Chadbourne. Report, '92, 1131.

**Operations.**

1887-'88. 1,450 logs, trees, stumps, and snags removed from the river channel; 1,082 linear feet of pile and plank jetty built, '88, 867.

1888-'89. 3,121 linear feet of jetty built, and 31 brush mats laid; 438 linear feet old jetty and 1,155 logs, stumps, and trees, with 14 cords of small snags, removed from the channel, '89, 1058.

1889-'90. 1,660 trees, logs, and snags, 295 linear feet of old jetty, and 15 cords of small snags removed from the river; 2,673 trees and stumps cut and pulled back on the banks, and 336 cubic yards material excavated, '90, 1124.

1890-'91. 1,361 linear feet of sheet pile jetty built, and 325 linear feet of old jetty removed; 2,331 snags and trees and 27 cords of small snags cleared from the channel, '91, 1360.

1891-'92. 1,882 snags and logs and 23 cords of small snags cleared from the channel, and 3,194 trees and logs and 96 cords of brush removed from the banks, '92, 1132.

**Projects.**

The projects of 1871 to 1883 proposed the removal of obstructions placed in the river during the civil war, and the removal of logs and snags; also the construction of the channel way so as to secure during the entire year an unobstructed 8-foot navigation for 40 miles to Newbern, a 4-foot navigation for 50 miles farther to Kinston, and during 9 months of the year a 3-foot navigation 108 miles farther to Smithfield, '79, 93, 704, 705; '85, 166; '86, 973, 983; '87, 1020.

Total amount appropriated from 1878 to 1886, inclusive, was \$237,500, when \$142,000 was estimated for completion of project, '86, 981, 982; '87, 1023; '91, 1359.

**Surveys.****MAPS.**

'89, 1058; '90, 1126; '92, Atlas, 26.

**NEW BEDFORD HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 346.)

**Appropriations.**

1836-'79 .....	\$37, 691. 37
1888 .....	10, 000. 00, '88, 513.
1890 .....	10, 000. 00, '90, 562.
1892 .....	7, 500. 00, '92, 611.

Total ..... 65, 191. 37

**Commerce.**

Growth of commerce and increase in draft of steamers engaged, '88, 513.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 36, 44; '89, 47; '90, 41; '91, 51; '92, 55.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. H. Elliot, 1886-'89. Report, '88, 513.

Maj. W. R. Livermore, 1887-'92. Reports, '88, 514; '89, 615; '90, 560; '91, 704.

Capt. W. H. Bixby, 1892-'— . Report, '92, 609.

**Operations.**

1887-'89. No operations, '88, 513; '89, 616.

1889-'90. 43,665 cubic yards material dredged, '90, 562.

1890-'91. No operations, '91, 705.

1891-'92. 28,720 cubic yards material dredged, '92, 610.

**Projects.**

The original improvement of this harbor was completed in 1878 at a cost of \$20,000, '78, 227; '80, 73.

In 1887 Maj. Livermore proposed the further improvement of the harbor by excavation of a channel 200 feet wide and 18 feet deep from deep water off Clarke Point to the wharves of New Bedford near the bridge; estimated cost, \$34,749, '88, 514, 515; '92, 610.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1887, under direction of Maj. Livermore, '88, 514.

**NEWBERN TO BEAUFORT, N. C.—IMPROVEMENT OF INLAND LINE OF NAVIGATION BETWEEN, VIA CLUBFOOT, HARLOWE, AND NEWPORT RIVERS.**

(Continued from Vol. II, p. 346.)

**Appropriations.**

1886-'87 .....	\$10, 000
1888 .....	15, 000, '88, 873.

Total ..... 25, 000

**Commerce.**

Value of the improvement, '88, 873.

**Contracts.**

1889. Alabama Dredging and Jetty Company, for dredging, at 33 cents per cubic yard, '89, 1064.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 120; '89, 139; '90, 125; '91, 160; '92, 161.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1884-'92. Reports, '88, 871; '89, 1060; '90, 1127; '91, 1363.

Maj. W. S. Stanton, 1892-'— . Report, '92, 1134.

**ASSISTANTS.**

E. D. Thompson. Reports, '88, 874; '89, 1064; '90, 1130.

W. H. Chadbourne. Report, '91, 1366.

**Operations.**

1887-'88. 4,924 cubic yards material dredged, '88, 877.

1888-'89. 81,932 cubic yards material dredged, and 90 logs and stumps removed from channel, '89, 1062.

1889-'90. 8,654 cubic yards material dredged, '90, 1130.

1890-'91. 60 linear feet of jetty built, and 3,390 linear feet of jetty riprapped with oyster shells, '91, 1365.

1891-'92. No operations, '92, 1134.

**NEWBURN TO BEAUFORT, N. C.—Continued.****Projects.**

The project of 1885 proposed the formation of a dredged channel 30 feet wide and 5 feet deep from Newburn to Beaufort, via Clubfoot, Harlowe, and Newport rivers, a distance of 42 miles, at an estimated cost of \$92,000, '85, 1074; '86, 984; '87, 1027.

In 1889 this cost was reduced by \$10,000, '89, 1063; '92, 1135.

**Surveys.****MAPS.**

'89, 1062; '90, 1130.

**NEWBURYPORT HARBOR, MASS.—IMPROVEMENT OF.**

(See also MERRIMAC RIVER.)

(Continued from Vol. II, p. 348.)

**Appropriations.**

1880-'87 .....	\$207, 500
1888 .....	25, 000, '88, 435.
1890 .....	25, 000, '90, 483.
1892 .....	20, 000, '92, 553.

Total ..... 277, 500

**Contracts.**

1888. Rockport and Pigeon Hill Granite Company, for delivering of rubble stone, at \$1.97 per ton, '89, 556.

1890. J. H. White, for rubble stone, at \$1.47 per ton, '91, 628.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 22; '89, 32; '90, 27; '91, 33; '92, 40.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 433.

Lieut. Col. S. M. Mansfield, 1889-'— . Reports, '89, 554; '90, 482; '91, 626; '92, 551.

**Operations.**

1887-'88. 3,443 tons of rubble stone deposited in north jetty, '88, 434.

1888-'89. 5,185 tons rubble stone deposited in north jetty, extending the same 150 feet, '89, 555.

1889-'90. 4,814 tons rubble stone delivered in north jetty, '90, 483.

1890-'91. 4,279 tons of rubble stone placed in north jetty, '91, 627.

1891-'92. 11,445 tons of rubble stone placed in north jetty, '92, 552.

**Projects.**

From 1828 to 1834, inclusive, \$60,366 were appropriated for the removal of a sand bar at the mouth of the Merrimac, and for breakwater construction.

By Lieut. Col. Thom, 1880, for securing a constant depth of 17 feet across the bar at mean low water by construction of two converging rubble-stone jetties, extending from Salisbury Bend and Plumb Island; estimated cost, \$365,000, '81, 502, 509, 511. Recommended by Board of Engineers, '81, 505. Concurred in by Chief of Engineers, '81, 505.

In 1881 a dike closing Plumb Island Basin was proposed, increasing cost of the project to \$375,000, '84, 494.

In 1883 the project was modified by changing the direction of south jetty and substituting for the apron beach protection a sand catch in rear and in prolongation of south jetty, '83, 437; '86, 60; '87, 490.

**Surveys.****MAPS.**

'88, 434; '89, 556; '90, 582; '91, 627; '92, Atlas, 2.

**NEW CASTLE, DEL.—ICE HARBOR AT.**

(Continued from Vol. II, p. 349.)

**Appropriations.**

1826-'87 .....	\$223, 573
1888 .....	7, 500, '88, 741.
1890 .....	8, 100, '90, 922.

Total ..... 239, 173

List of appropriations, '88, 741.

**NEW CASTLE, DEL.**—Continued.**Commerce.**

Importance of New Castle as a harbor of refuge, '88, 741.

**Contracts.**

Delaware Construction Company, for removal of old pier and construction of new ice pier, at a total of \$9,500, '92, 950.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 88; '89, 103; '90, 94; '91, 120; '92, 121.

**BOARD OF ENGINEERS.**

Mr. Smith recommended that harbor lines be established upon the lines adopted in 1873 by the commissioners appointed by the legislature of Delaware, with certain modifications. Approved by Secretary of War, '91, 1225.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885—'. Reports, '88, 740; '89, 883; '90, 921; '91, 1160, 1225; '92, 948.

**Operations.**

1887-'88. 252 cubic yards riprap placed around Piers K and M; Pier N repaired; work done by hired labor, '88, 740, 741.

1888-'91. No operations, '89, 884; '90, 922; '91, 1160.

1891-'92. Old pier renewed and ice pier constructed, '92, 948.

**Projects.**

By Col. Macomb, 1881, for construction of one additional pier and dredging; estimated cost, \$23,000, '81, 768.

By W. F. Smith, 1884, for removal and reconstruction of Pier H, repairs to Pier K, and dredging; estimated cost, \$20,600, '85, 875, 876; '86, 126.

**NEW HAVEN, CONN.**—CONSTRUCTION OF BREAKWATER AT.

(Continued from Vol. II, p. 350.)

**Appropriations.**

1879-'87 .....	\$295,000
1888 .....	75,000, '88, 547.
1890 .....	120,000, '90, 626.
1892 .....	120,000, '92, 676.

Total ..... 610,000

List of appropriations, '88, 547.

**Commerce.**

Shipments, '89, 681, 684.

Value of the harbor to shipping, '89, 683.

**Contracts.**

1888. J. Beattie, for riprap breakwater extension, at \$1.35 per ton, '88, 548.

1889. J. Beattie, for riprap breakwater extension, at \$1.22 per ton, '89, 679.

1890. J. J. Moran, for breakwater construction, riprap granite, at \$1.07 per ton, '91, 769.

1891. J. J. Moran, for breakwater construction, riprap sandstone, at \$1.04 per ton, '92, 677.

1892. J. J. Moran, for breakwater enlargement, at \$1.14 per ton for riprap, '92, 677.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 48; '89, 60; '90, 54; '91, 68; '92, 72.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886—'. Reports, '88, 544; '89, 675, 679; '90, 622; '91, 766; '92, 673.

**Operations.**

1887-'88. 31,430 tons stone received, and 406 linear feet of breakwater built, '88, 546.

1888-'89. 20,204 tons stone delivered in the breakwater, '89, 677.

1889-'90. 26,512 tons stone delivered in the breakwater, '90, 624.

1890-'91. 18,019 tons riprap delivered in the breakwater, '91, 768.

1891-'92. 46,774 tons of granite and 24,491 tons sandstone placed in breakwater, '92, 675.

**Physical Characteristics.**

Description of the harbor, '88, 544.

## NEW HAVEN, CONN.—Continued.

**Projects.**

By Board of Engineers, 1879, for formation of a harbor of refuge for vessels of 20 feet draft by construction of two breakwaters of riprap granite, one extending from southwest ledge in a northeasterly direction to Quixes Ledge, a distance of 3,300 feet, the average height being 32 feet; the other beginning at Ludingtons Rock, with a westerly direction and a length of 4,200 feet, and average height of 28 feet; width at the top, 12 feet; height above high-water plane, 6 feet; total estimated cost of east and west breakwaters, \$1,311,134, '80, 448,450; '87, 602.

In 1889 the project was modified by Col. Houston by the relocation of the westerly breakwater 6,000 feet to the southwest, the construction of a middle breakwater, commencing at a point 1,000 feet N., 54° E. from Ludington Rock and extending S. 54° W. 5,000 feet, crossing the rock; and also a breakwater about 1,200 feet long to partly close the space between Quixes Ledge and the east shore; the cross section of these breakwaters to be the same as that of the one from the southwest ledge to Quixes Ledge; total estimated cost of revised project, \$2,151,134, '89, 678; '91, 768.

**Surveys.****MAPS.**

'89, 678.

## NEW HAVEN HARBOR, CONN.—IMPROVEMENT OF.

(Continued from Vol. II, p. 351.)

**Appropriations.**

1827-'87 .....	\$261,000
1888 .....	15,000, '88, 543.
1890 .....	15,000, '90, 621.
1892 .....	15,000, '92, 672.

Total ..... 306,000

List of appropriations, '88, 543.

**Contracts.**

1889. John Beattie, for furnishing stone, at \$1.16 per ton, '89, 674.

1891. C. DuBois and H. E. Du Bois, for dredging, at 9.9 cents per cubic yard, '91, 765.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 48; '89, 59; '90, 54; '91, 67; '92, 71.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886-'—. Reports, '88, 540; '89, 670; '90, 617; '91, 761; '92, 668.

**Operations.**

1887-'88. 4,951 tons stone delivered in dike, completing same for a length of 570 feet, '88, 542.

1888-'89. 5,081 tons stone placed in the dike, '89, 673.

1889-'90. 5,379 tons riprap placed in the Sandy Point Dike, and 11,308 cubic yards material dredged, '90, 620.

1890-'91. 139,806 cubic yards material dredged, '91, 763.

1891-'92. No operations, '92, 761.

**Physical Characteristics.**

Description of harbor, '88, 540.

**Plans.**

By Col. Houston, 1889, for the formation of a larger harbor by the construction of two breakwaters, the first commencing at Ludingtons Rock and extending in a southwesterly direction about 2 miles; second, a breakwater to commence at a point in the prolongation of the first and about one-half mile from its western extremity, and extending in a northwesterly direction about a mile; the cost of these works is estimated at about \$5,000,000, '89, 679, 680.

**Projects.**

The earliest project for the expenditure of the appropriation of \$6,000 in 1852 seems to have been for the removal of Middle Rock, '66, i, 7, 37, which was in progress in 1866-'67, '67, 44, 451.

The project of 1870 proposed the formation of a dredged channel 13 feet at low water up to the city wharves, '71, 85, 769, 779. In 1871, 1872, 1875, and 1877 the project was modified so as to provide for a channel 16 feet deep above Fort Hale Bar, '72, 861; '75, ii, 249-251; '77, 212; '79, 336.

**NEW HAVEN HARBOR, CONN.—Continued.****Projects—Continued.**

In 1879 it was proposed to increase the depth over Fort Hale Bar by the construction of a dike from Sandy Point, '79, 338.

From 1852 to 1886, inclusive, \$261,000 was appropriated, when it was estimated that \$80,000 would be required to complete the project, '86, 637.

In 1887 the estimates for Sandy Point dike and dredging through Fort Hale Bar were revised, requiring \$93,000 to complete existing project, '87, 600; '91, 761.

**NEW LONDON HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 352.)

**Appropriations.**

1880-'87 ..... \$17,300

List of appropriations, '88, 527.

**Commerce.**

Commerce to be benefited by future improvement, '89, 745.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 45; '89, 57, 70; '90, 51; '91, 64.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1886-'—. Reports, '88, 525; '89, 659, 744; '90, 604; '91, 746.

**Operations.**

1887-'90. No operations, work under the existing project being practically completed, '88, 526; '89, 660; '90, 605; '91, 748.

**Physical Characteristics.**

Description of harbor, '88, 525; '89, 744.

**Plans.**

By Col. Houston, 1888, for deepening the shoal between the city wharves and the main channel by the excavation of a 15-foot channel 200 feet wide and 3,000 feet long, extending from the upper end of the steamboat wharf to Chappell's lower wharf; estimated cost, \$15,000, '89, 745.

**Projects.**

By Maj. Barlow, 1878, for removal of sand and bowlder shoal in New London Harbor lying east of the New London Northern Railroad Wharf to a depth of 16 feet at mean low water; estimated cost, \$6,800, '78, 397. Afterwards increased on account of difficulty in excavation to \$24,000, '81, 586; '86, 632, 633; '87, 525. This project was completed in 1888, '88, 526.

**NEW ORLEANS HARBOR, LA.—(See MISSISSIPPI RIVER BETWEEN MOUTH OF THE OHIO AND HEAD OF THE PASSES.)****NEWPORT HARBOR, CAL.—SURVEY OF.**

(Continued from Vol. II, p. 353.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 293.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaard, 1886. Report, '88, 2118.

**Physical Characteristics.**

Description of the harbor, '88, 2118.

**Plans.**

By Maj. Benyaard, 1888, for improvement of the harbor entrance, securing a navigable channel 8 feet in depth at mean low water by revetment of head of sand spit, and construction of an eastern jetty of stone 2,200 feet in length and a western jetty 3,000 feet in length; estimated cost, \$1,520,000, '88, 2120.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Maj. Benyaard, '88, 2118.



**NEWPORT CREEK, head of Wicomico River, Md.—EXAMINATION OF.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 146.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1891. Report, '91, 1281.

**Physical Characteristics.**

Description of the locality, '91, 1281.

**Plans.**

In 1891 Lieut. Col. Hains did not consider the locality worthy of improvement, '91, 1282.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Hains, '91, 1281.

**NEWPORT HARBOR, R. I.—EXAMINATION FOR REMOVAL OF SPIT AT SOUTH END OF ISLAND.**

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 62.

ENGINEER IN CHARGE.

Maj. W. R. Livermore, 1890. Report, '91, 736.

**Plans.**

By Maj. Livermore, 1890, for improvement of the harbor by dredging a shoal at the south end of Goat Island to a depth of 15 feet at mean low water; estimated cost, \$24,200, '91, 736.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Livermore, '91, 736.

**NEWPORT HARBOR, R. I.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 353.)

**Appropriations.**

1873-'87 .....	\$108,500
1888 .....	12,000, '88, 504.
1890 .....	12,500, '90, 574.
1892 .....	25,000, '92, 627.

Total ..... 158,000

**Contracts.**

1891. Hartford Dredging Company, for dredging, at 20½ cents per cubic yard, '91, 721.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 40; '89, 51; '90, 46; '91, 57; '92, 61.

ENGINEERS IN CHARGE.

Maj. W. R. Livermore, 1887-'92. Reports, '88, 502; '89, 628; '90, 572; '91, 719.

Capt. W. H. Bixby, 1892-'— . Report, '92, 625.

**Operations.**

1887-'88. Excavation of 13-foot anchorage area completed, '88, 503.

1888-'89. No operations, '89, 630.

1889-'90. 39,601 cubic yards material dredged, '90, 574.

1890-'91. 34,846 cubic yards material dredged, '91, 720.

1891-'92. No operations, '92, 627.

**Physical Characteristics.**

Description of the locality, '89, 628.

**NEWPORT HARBOR, R. I.—Continued.****Projects.**

By Lieut. Col. Warren, 1873, and modified in 1882, for improvement of the harbor by dredging the southern entrance to 15 feet mean low water and widening the same to a line drawn from the dolphin which marks the spit, clearing the permanent dock at Fort Adams by 100 feet; by excavation of a channel 750 feet wide and 15 feet deep at mean low water around and to the entrance of the buoy marking Goat Island Spit; by excavation of anchorage area to a mean low-water depth of 13 feet; also for excavation of a 10-foot channel south to a point opposite the Gas Company's Wharf, and construction of jetties on western shore of Goat Island; estimated cost, 1873, \$72,000, '73, 964; '82, 561. Estimate of revised project in 1882, \$132,000, '82, 561; '85, 603, 604; '86, 606.

In 1890, after the appropriation of \$133,000, it was estimated that \$27,500 would be required for completion of the project, '90, 575.

In 1892 the project was extended to include the removal of the spit at the southern end of Goat Island to a depth of 15 feet, at an estimated cost of \$24,200, increasing the total estimated cost of the project to \$156,200, '92, 627.

**NEW RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 354.)

**Appropriations.**

1836-'87 .....	\$25,000
1888 .....	3,000, '88, 887.
1890 .....	5,000, '90, 1143.
1892 .....	5,000, '92, 1151.

Total ..... 38,000

**Contracts.**

1890. Alabama Dredging and Jetty Company, for dredging, at 49 cents per cubic yard, '91, 1381.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 123; '89, 142; '90, 128; '91, 163; '92, 163.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 885; '89, 1078; '90, 1141; '91, 1379.

Maj. W. S. Stanton, 1892-'— . Report, '92, 1149.

**ASSISTANTS.**

E. D. Thompson. Reports, '88, 887; '89, 1079; '90, 1143.

W. H. Chadbourn. Report, '91, 1381.

**Operations.**

1887-'88. 24,861 cubic yards material dredged, '88, 886.

1888-'90. No operations, '89, 1080; '90, 1142.

1890-'91. 530 linear feet of oyster-shell dike built, '91, 1380.

1891-'92. No operations, '92, 1150.

**Physical Characteristics.**

Original condition of the river, '88, 885.

**Projects.**

By Capt. Mercur, 1882, for excavation of a channel 7,000 feet long, 150 feet wide, and 5 feet deep at mean low water through the bar at New River Inlet, connecting the upper river with the ocean; estimated cost, \$40,000, '82, 1117; '91, 1380.

**Surveys.**

Survey of river from Cedar Bush Marsh to the Ocean Bar. Made, 1890, under direction of Capt. Bixby, '90, 1142.

**MAPS.**

'90, 1144; '91, 1381.

**NEW RIVER, VA. AND W. VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 355.)

**Appropriations.**

1876-'87 ..... \$112,000

List of appropriations, '92, 2071.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 225; '89, 261; '90, 235; '91, 302; '92, 289.

**NEW RIVER, VA. AND W. VA.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Col. W. P. Craighill, 1873-'—. Reports, '88, 1760; '90, 2249; '91, 2430; '92, 2071.  
 Capt. T. Turtle, 1889. Report, '89, 1961.

**ASSISTANT.**

W. P. Smith. Reports, '89, 1961; '90, 2249.

**Operations.**

1887-'88. No operations, '88, 1760.

1888-'89. Drilling, blasting, and rock removal begun, '89, 1962.

1889-'90. 2,204 cubic yards material excavated and built into training and wing walls, '90, 2250.

1890-'92. No operations, '91, 2433; '92, 2071.

**Projects.**

The projects of 1877 proposed an improvement from the mouth of Greenbrier River to Lead Mines for keel-boat navigation to depth of 2 feet and width of 30 feet; estimated cost, \$156,160, '77, 332; '79, 530, 532.

In 1880, \$66,000 having been appropriated since 1876, the project was modified so as to embrace that part of the river between the mouth of Wilsons River and Lead Mines, at an estimated cost of \$205,000, '80, 677.

**NEW RIVER AND SWANSBORO, N. C.—EXAMINATION OF WATERWAY BETWEEN.****Appropriations.**

1890..... \$5,000, '91, 1378.

**Commerce.**

Prospective increase in, to result from improvement, '89, 1125.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 148; '91, 162; '92, 163.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1888-'92. Reports, '89, 1124; '91, 1376.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1146.

**ASSISTANT.**

W. H. Chadbourne. Report, '91, 1378.

**Physical Characteristics.**

Description of the locality, '89, 1125.

**Projects.**

By Capt. Bixby, 1889, for excavation of a 3 or 4 foot navigable channel from Swansboro to New River; estimated cost, \$43,000, '89, 1127; '91, 1377.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1124.

Survey made, 1891, under direction of Capt. Bixby, '92, 1146.

**MAPS.**

'91, 1378.

**NEW ROCHELLE HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 355.)

**Appropriations.**

1881-'82..... \$35,000

List of appropriations, '88, 573.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 54; '89, 67; '90, 60; '91, 74.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1888-'—. Reports, '88, 572; '89, 719; '90, 654; '91, 804.

**Operations.**

1887-'88. Steam drilling plant repaired, and 229 cubic yards of rock removed, '88, 573.

1888-'89. No operations, '89, 720.

1889-'90. 40,700 cubic yards material dredged by hired labor, '90, 655. Improvement practically completed save removal of Rock "C," which is not considered necessary; no further work is therefore proposed, '90, 656.

1890-'91. No operations, '91, 805.

**NEW ROCHELLE HARBOR, N. Y.—Continued.****Physical Characteristics.**

Description of the harbor, '88, 572; '89, 719. .

**Projects.**

By Col. Newton, 1881, for excavation of a channel 100 feet wide and 8 feet deep at mean low water around south end of Glen Island; also formation of approaches to Glen Island and Flat Island by removal of "Corning Rock" to 12 feet and Rock "C" to a depth of 9 feet low water, and the removal of part of a reef at the entrance to the dredged channel; estimated cost, \$40,825, '81, 645; '86, 654; '87, 626.

**NEWTOWN CREEK, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 356.)

**Appropriations.**

1880-'87 .....	\$82,500
1888.....	25,000, '88, 609.
1890.....	35,000, '90, 723.
1892.....	35,000, '92, 813.

Total ..... 177,500

List of appropriations, '88, 609.

**Contracts.**

1889. J. A. Simmons, for dredging, at 18½ cents per cubic yard, '89, 779.

1890. Atlantic Dredging Company, for dredging, at 26 and 40 cents per cubic yard, '91, 910.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 61; '89, 76; '90, 68; '91, 87; '92, 91.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. W. McFarland, 1885-'89. Report, '88, 606.

Lieut. Col. G. L. Gillespie, 1889-'— Reports, '89, 777; '90, 720; '91, 906; '92, 810.

**Operations.**

1887-'88. 50,248 cubic yards material dredged, '88, 608.

1888-'89. 7,738 cubic yards material dredged, '89, 779.

1889-'90. 83,850 cubic yards material dredged, '90, 722.

1890-'91. 78,520 cubic yards material dredged, '92, 909.

1891-'92. 15,648 cubic yards material dredged, '92, 819.

**Physical Characteristics.**

Description of the creek, '88, 606.

**Projects.**

By Col. Newton, 1880, for improvement of the creek by deepening the channel from 18 to 21 feet low water and 200 feet wide from mouth to Vernon Avenue; estimated cost, \$44,050, '80, 511; '81, 636; '82, 662; '86, 96.

By Lieut. Col. Gillespie, 1884, for improvement of creek from Vernon Avenue Bridge to head of navigation by excavation of a channel from 125 to 150 feet wide, and with a depth of 18 feet to the Central Oil Works, 15 feet to Queens County Oil Works, 12 feet to Nichol's Chemical Works, and 10 feet thence to the head of navigation; estimated cost, \$255,569, '84, 766; '86, 718; '87, 699; '92, 810.

**NEW YORK HARBOR.—IMPROVING GEDNEYS AND MAIN SHIP CHANNELS.**

(Continued from Vol. II, p. 357.)

**Appropriations.**

1884-'87 .....	\$950,000
1888.....	380,000, '88, 623.
1889.....	*94,070
1890.....	{ 160,000, '90, 739.
	{ *33,000
1891.....	*33,000
1892.....	{ 170,000, '92, 832.
	{ *33,000

Total ..... 1,853,070

List of appropriations, '88, 622.

\*Preventing obstructions through illegal dumping.

**NEW YORK HARBOR—Continued.****Commerce.**

Draft of vessels using the channel, '88, 619. Gross export and import of New York City, '90, 732. List of transatlantic steamships plying between New York City and foreign ports, giving tonnage, dimensions, and draft for 1885, and from April, 1889, to April, 1890, '90, 742.

Report upon height of masts of vessels of the largest class which enter the port of New York, '90, 749.

List of sailing vessels over 800 tons which entered and cleared at the custom-house, port of New York, January, 1890, '90, 752.

Imports and exports of New York Harbor for 1891, '91, 930; for 1892, '92, 832.

**Contracts.**

1889. Brainard Dredging Company, for dredging, at 16½ cents per cubic yard, '91, 925. Contract annulled, '91, 926.

1890. Joseph Edwards Dredging Company, for dredging, at 23½ cents per cubic yard, '91, 925. Joseph Edwards Dredging Company, for dredging, at 22.6 cents per cubic yard, '91, 926. J. S. Howell, for broken stone, at 90 cents per ton, '91, 927.

1891. Joseph Edwards Dredging Company, for dredging, at 23.9 cents per cubic yard, '91, 926. J. Satterlee, for broken stone, at 79 cents per ton, '91, 927.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 63; '89, 90, 368; '90, 71, 332; '91, 90, 424; '92, 95, 398.

**BOARD OF ENGINEERS.**

Convened at New York City, March 26 and June 4, 1889, by S. O. No. 49, to establish harbor lines (a) on East River between Fifty-ninth and Sixty-fourth streets, New York City; (b) for the north and east shores of Staten Island from New Brighton to Fort Wadsworth. Report, '89, 807, 809. (Cols. Abbot and Comstock and Lieut. Cols. Houston and Gillespie.)

Convened at New York City, December 18, 1889, by S. O. No. 11, to examine and report upon the establishment of harbor lines in New York Harbor and adjacent waters. Reports, '90, 786; '92, 849. (Cols. Abbot, Craighill, Comstock, and Houston, and Lieut. Col. Gillespie.)

Convened at New York City, September 17, 1890, by S. O. No. 49, to establish harbor lines in New York Harbor and its adjacent waters. Harbor lines as established for east side of Manhattan Island, '91, 958; Raritan River, '91, 960; Newtown Creek, '91, 961; East River, '91, 963; Jersey Flats, '91, 965. Modification of pier and bulkhead lines on north shore of Staten Island, '91, 973. (Cols. Abbot, Craighill, Comstock, Houston, and Lieut. Col. Gillespie.)

**ENGINEERS IN CHARGE.**

Lieut. Col. W. McFarland, 1885-'89. Report, '88, 617.

Lieut. Col. G. L. Gillespie, 1889-'— . Reports, '89, 788; '90, 732, 786; '91, 922; '92, 824.

**Legislation.**

An act to prevent deposits within New York Harbor and adjacent waters, '88, 623.

**Operations.**

1887-'88. 580,405 cubic yards material dredged from the bars, '88, 619.

1888-'89. 1,394,777 cubic yards material dredged, '89, 792.

1889-'90. 1,318,178 cubic yards material dredged, '90, 739.

1890-'91. 1,008,097 cubic yards material dredged, '91, 928.

1891-'92. 213,268 cubic yards material dredged; 3,110 tons stone placed in sea wall on north shore of Sandy Hook, '92, 829, 831.

**Physical Characteristics.**

Description of the harbor, '88, 617.

**Projects.**

By Lieut. Col. Gillespie, 1884, for the formation, by dredging, of a channel through the shoal in the west end of Gedneys Channel 4,000 feet long, 1,000 feet wide, and 30 feet deep at mean low water, extending from deep water below the "Narrows" through the main ship channel and Gedneys Channel to deep water outside the bar, '85, 777. Recommended for approval by Board after reducing proposed depth of channel to 28 feet, '85, 773, 778; '86, 730.

Approved by Secretary of War, '85, 774. Successful results from dredged channel, '87, 63, 720.

The act of August 5, 1886, provides for the formation of channels 30 feet deep at mean low water, '87, 63, 718.

The Board of Engineers of 1886 recommended that the appropriation of \$750,000 made in 1886 be applied wholly in Gedneys and the main ship channels, '87, 720, 733.

**NEW YORK HARBOR—Continued.****Projects—Continued.**

The modified project of Lieut. Col. Gillespie involved the removal of 4,300,000 cubic yards of material, at an estimated cost of \$1,490,000, '88, 618; '91, 925.

**Surveys.****MAPS.**

'92, Atlas, 4.

**NEW YORK HARBOR.—SEA WALLS ON GOVERNORS ISLAND.****Appropriations.**

1888.....	\$50,000, '90, 383.
1890.....	50,000, '91, 526.

Total ..... 100,000

**Contracts.**

1889. F. H. Smith, for sea-wall construction, concrete foundation, at \$14.70 per cubic yard; masonry wall, at \$15 per cubic yard, '90, 384. M. Donnelly, for filling, at 22½ cents per cubic yard, '90, 384.

1890. Breuchand, Pennell & Co., for sea-wall construction, at a total of \$52,160, '91, 527.

1892. M. Flaherty, for sea-wall construction, at \$23.38 per linear foot, '92, 463.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 9; '92, 12.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1889-'—. Reports, '90, 383; '91, 524; '92, 461.

**Operations.**

1889-'90. 319 cubic yards concrete foundation and 1,145 cubic yards of masonry wall laid; 21,447 cubic yards of embankment completed, '90, 384.

1890-'91. 1,153 cubic yards of filling delivered in the work; 144 cubic yards of concrete foundation put in sea wall, '91, 526.

1891-'92. 510 cubic yards of concrete and 1,345 linear feet of masonry wall laid, '92, 462.

**NEW YORK HARBOR.—SEA WALL AND EMBANKMENT AT DAVIDS ISLAND.****Appropriations.**

1888.....	\$47,000, '90, 382.
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**Contracts.**

1889. J. Sheehan, for riprap sea-wall construction, at \$1.50 per ton, \$7 per linear foot for capping, and filling at 40 cents per cubic yard, '90, 383.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 9; '92, 12.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1889-'—. Reports, '90, 382; '91, 521; '92, 457.

**Operations.**

1889-'90. 5,022 tons of riprap placed in completion of sea wall, and capping laid; 27,656 cubic yards material placed in embankment, '90, 382.

1890-'91. 3,555 cubic yards filling delivered in embankment, '91, 522.

1891-'92. No operations, '92, 458.

**Projects.**

By Col. Houston, 1892, for protection of Davids Island by construction of a sea wall 1,100 feet in length on the west side, and one 500 feet in length on the north side, at an estimated cost of \$44,000, '92, 460, 461.

**Surveys.**

Survey of Davids Island, New York Harbor, for sea wall on the west side and at other points. Made, 1891, under direction of Col. Houston, '91, 523; '92, 459.

**NIAGARA FALLS, N. Y.—EXAMINATION OF WATERWAY AROUND.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 337.

ENGINEER IN CHARGE.

Capt. C. F. Palfrey, 1888-'89. Report, '89, 2434.

**Plans.**

By Capt. Palfrey, 1889, for a waterway around Niagara Falls of capacity and facilities sufficient to float merchant ships and ships of war of modern build drawing 20 feet of water, the waterway to commence in a navigable part of Niagara River, at or near Tonawanda, and to end in the navigable waters of said river below the falls. The estimated cost of Route No. 4, known as the Wilson or Twelve Mile Creek line, with 18 lifts, would be, if single locks, \$24,201,550; if double locks, \$29,347,900. The estimated cost of Route No. 5, known as the Oleott or Eighteen Mile Creek route, with 18 lifts, would be \$23,617,900, '89, 338, 2436.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Palfrey, '89, 2434.

**NIAGARA RIVER, N. Y., from Tonawanda to Port Day.—**  
SURVEY OF.**Appropriations.**

1892..... \$20,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '92, 357.

ENGINEER IN CHARGE.

Maj. Amos Stickney, 1891. Report, '92, 2539, 2541.

ASSISTANT.

E. Siegesmund. Report, '92, 2545.

**Physical Characteristics.**

Description of the locality, '92, 2542.

**Plans.**

By Maj. Stickney, 1891, for formation of a channel 300 feet wide from Tonawanda down to Connors Island, 200 feet wide from Connors Island to Grass Island, and increasing from 200 to 400 feet width from Grass Island to Port Day; also for the construction of an embankment from rock excavated from the channel, extending from Connors Island to Port Day so as to inclose the lower end of the channel; estimated cost, \$257,829, '92, 2544.

**Surveys.**

Ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Stickney, '92, 2541.

**NOMINI CREEK, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 360.)

**Appropriations.**

1873-'82 .....	\$32,500
1888 .....	5,000, '88, 817.
1890 .....	5,000, '90, 1064.
1892 .....	10,000, '92, 1048.

Total ..... 52,500

List of appropriations, '88, 817.

**Commerce.**

Industries affected by improvement, '88, 817.

**Contracts.**

1888. C. W. Ridley, for dredging, at 25 cents per cubic yard, '89, 1003.

1891. F. L. Somers, for dredging, at 26½ cents per cubic yard, '91, 1260.

**NOMINI CREEK, VA.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 109; '89, 126; '90, 113; '91, 140; '92, 141.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1874-'92. Reports, '88, 816; '89, 1003; '90, 1063; '91, 1259.

Maj. C. E. L. B. Davis, 1892-'— Report, '92, 1047.

**Operations.**

1887-'88. No operations for lack of funds, '88, 817.

1888-'89. 12,738 cubic yards material dredged, '89, 1003.

1889-'90. No operations for lack of funds, '90, 1063.

1890-'91. 10,927 cubic yards material dredged; 406 cubic yards riprap used in dike construction, '91, 1260, 1261.

1891-'92. No operations, '92, 1048.

**Projects.**

The original project, adopted in 1873, provided for dredging a channel through the bar 100 feet wide and 9 feet deep at low tide, at an estimated cost of \$20,000, '73, 75, 774.

The project was amended in 1879 by increasing the width to 150 feet, '79, 606.

In 1885 the project was again modified so as to provide for a channel 200 feet wide and 9 feet deep, and also for dredging a training channel and the construction of training dikes; total estimated cost of amended project, \$62,500.

In 1888, owing to deterioration during the suspension of work from 1883 to 1889, this estimate was increased to \$72,500, '91, 1260; '92, 1047.

**Surveys.****MAPS.**

'89, 1004.

**NORFOLK HARBOR, VA., and the approaches thereto.—  
IMPROVEMENT OF.**

(Continued from Vol. II, p. 361.)

**Appropriations.**

1876-'87	{ Harbor.....	\$435,000	
	{ Approach .....	187,500	
1888	{ Harbor.....	50,000	'88, 766, 768.
	{ Approach .....	10,000	
1890.	Harbor.....	150,000,	'90, 1022.
1892.	Harbor.....	150,000,	'92, 1086.

Total ..... 982,500

List of appropriations, '92, 1086.

**Contracts.**

1888. Morris & Cumings, for dredging, at 13 cents per cubic yard, '89, 946. P. S. Ross, for dredging, at 12½ cents per cubic yard, '89, 949.

1891. National Dredging Company, for dredging, at 10.7 cents per cubic yard, '91, 1292.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 98, 99; '89, 115, 116, 366; '90, 104, 105, 333; '91, 146, 147; '92, 147, 149.

**BOARD OF ENGINEERS.**

Convened at Baltimore, March 26, 1889, by S. O. No. 13, to establish harbor lines in Norfolk and Portsmouth harbors. Reports, '89, 979; '90, 1030. (Col. Craig-hill, Lieut. Col. Hains, and Lieut. Fiebeger.)

**ENGINEERS IN CHARGE.**

Col. W. P. Craighill, 1888-'89. Report, '88, 766, 767.

Capt. G. J. Fiebeger, 1889-'—. Reports, '89, 945, 949; '90, 1021, 1023; '91, 1291, 1295, 1296.

Lieut. E. Burr, 1892-'—. Report, '92, 1085, 1089.

**Operations.**

1887-'88. No operations, '88, 766, 767.

1888-'89. 360,957 cubic yards material dredged in harbor, and 796,955 cubic yards material dredged from approach, '89, 946, 949.

1889-'90. 20,000 cubic yards material dredged from approach, '90, 1023.

1890-'91. 273,032 cubic yards material dredged from the bar at Sewells Point, '91, 1292.

1891-'92. 991,704 cubic yards material dredged, '92, 1086.



**NORFOLK HARBOR, VA., and the approaches thereto—**  
Continued.

**Projects.**

By United States Advisory Board, 1878, for excavation of a channel 25 feet deep at mean low water and 500 feet wide from the deep water of Hampton Roads to Norfolk Harbor, and to the Gosport Navy-Yard above on the Southern Branch of the Elizabeth River; also for improvement of the harbor proper by dredging at mouth of Eastern Branch, and by dredging off the fore slopes of Portsmouth and Berkeley flats; estimated cost, \$378,000, '78, 73, 518; '79, 673; '80, 815.

From 1876 to 1884, inclusive, \$225,000 was appropriated for this work.

The revised project of 1885 provided for a channel 25 feet deep at low water and 500 feet wide by dredging from deep water at Hampton Roads to Norfolk and the navy-yard on the Southern Branch; also a channel on the Eastern Branch 22 feet deep and 300 feet wide at the Norfolk and Western Railroad Bridge, increasing to 700 feet at its mouth; a bulkhead 3,000 feet in length, bounding Berkeley Flats, to be built to receive the dredged material and maintain the dredged channel; estimated cost, \$507,744, '85, 155, 1016. Increased in 1889 by \$50,000, '89, 116.

By Capt. Hinman, 1885, for improvement of approach to Norfolk Harbor and United States navy-yard, by advancing port wardens' line from Point Norfolk to Lamberts Point, to 12-foot curve by constructing 4,000 linear feet of diking, and dredging channel to 25 feet mean low water; estimated cost, \$255,600, '85, 1026.

The Board of Engineers of 1887 considered that the Pinners Point Dike should not be built until the port wardens' line from Lamberts Point becomes an actuality, '87, 974.

In 1890 Lieut. Fiebeger reported that a channel of the desired width and depth having been secured through the Norfolk approach, the construction of the dike was unnecessary and no further appropriations were needed for this part of the harbor, '90, 1023.

**Surveys.****MAPS.**

'89, 946; '91, 1297.

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**NORFOLK TO ALBEMARLE SOUND, VA. AND N. C.—(See**  
CURRITUCK SOUND AND NORTH RIVER BAR, N. C.)

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**NORTH EAST RIVER, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 363.)

**Appropriations.**

1872-'87 .....	\$15,500
1890 .....	2,500, '91, 1183.
1892 .....	2,640, '92, 967.
Total .....	20,640

**Contracts.**

1891. C. T. Calor, for dredging, at 13½ cents per cubic yard, '91, 1183.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 112; '90, 102; '91, 124; '92, 124.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1888-'—. Reports, '90, 951; '91, 1182; '92, 967.

**ASSISTANT.**

A. Stierle. Report, '90, 951.

**Operations.**

1890-'91. 16,000 cubic yards material dredged, '91, 1183.

1891-'92. No operations, '92, 967.

**Physical Characteristics.**

Description of the locality, '90, 952.

**NORTH EAST RIVER, MD.—Continued.****Projects.**

By W. F. Smith, 1889, for excavation of a channel 75 feet wide and 6 feet deep at mean low water across the bar at the mouth of Stony Run; thence to the head of navigation a channel 60 feet wide and 6 feet deep; estimated cost, \$5,140, '90, 953.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Mr. W. F. Smith, '90, 953.

**NORTH EAST RIVER, CAPE FEAR, N. C.—SURVEY OF.****Appropriations.**

1890..... \$5,000, '91, 1385.  
1892..... 5,000, '92, 1153.

Total ..... 10,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 149; '90, 133; '91, 164; '92, 164.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1888-'92. Reports, '90, 1181; '91, 1383.

Maj. W. S. Stanton, 1892-'— Report, '92, 1152.

**ASSISTANT.**

C. Humphreys. Report, '91, 1385.

**Operations.**

1890-'91. 528 snags and stumps and 90 cords of small snags removed from the channel, and 216 trees and 145 cords of brush cleared from the banks, '91, 1386.

1891-'92. 33 snags and 1 steamboat wreck removed from the channel, '92, 1153.

**Physical Characteristics.**

Description of the locality, '90, 1182.

**Projects.**

By Capt. Bixby, 1889, for improvement from Wilmington up to Kornegays Bridge by removal of snags, logs, and similar obstructions; estimated cost, \$30,000, '91, 1384.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Bixby, '90, 1181.

**MAPS.**

'92, Atlas, 32, 33, 34, 35, 36.

**NORTH RIVER, MASS., from Beverly Bridge to the North Street Bridge.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 46.

**ENGINEER IN CHARGE.**

Lieut. Col. S. M. Mansfield, 1890. Report, '91, 669, 670.

**Physical Characteristics.**

Description of the locality, '91, 669, 670.

**Plans.**

In 1890 Lieut. Col. Mansfield did not consider the river worthy of improvement, '91, 669, 671.

**Surveys.**

Examination made, 1890, under direction of Lieut. Col. Mansfield, '91, 669, 670.

**NORTH RIVER, WASH.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 409.

**ENGINEER IN CHARGE.**

Capt. T. W. Symons, 1890. Report, '91, 3263, 3264.

**ASSISTANT.**

A. J. McMillan. Report, '91, 3266.

**NORTH RIVER, WASH.—Continued.****Plans.**

In 1891 Capt. Symons did not consider the locality worthy of improvement, '91, 3265.

**Surveys.**

Ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '91, 3265.

**MAPS.**

'91, 3265.

**NORTH FORKED DEER RIVER, TENN.—(See DEER RIVER, NORTH AND SOUTH FORKS OF.)****NORTH LANDING RIVER, VA. AND N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 363.)

**Appropriations.**

1879-'82 ..... \$55,500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '90, 107; '91, 151; '92, 153.

**ENGINEERS IN CHARGE.**

Col. W. P. Craighill, 1888-'90. Report, '88, 770.

Lieut. G. J. Fiebeger, 1890-'92. Reports, '90, 1027; '91, 1304.

Lieut. E. Burr, 1892-'— Report, '92, 1096.

**Operations.**

1887-'88. No operations, '88, 770.

1889-'90. 732 logs and stumps cleared from the river by hired labor, '90, 1027.

1890-'92. No operations, '91, 1304, '92, 1096.

**Projects.**

By Capt. Phillips, 1879, for the formation of a channel 80 feet wide at, and 9 feet deep above, ordinary stage of water for its entire length of 17 miles by straightening upper river at abrupt bends by dredging and by removal of stumps, snags, and similar obstructions; estimated cost, \$88,000, '79, 691, '80, 824. Not considered susceptible of permanent improvement, '86, 153.

**NORTH PALOUSE RIVER, WASH.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 364.

**ENGINEER IN CHARGE.**

Maj. W. A. Jones, 1888. Report, '89, 2592.

**Plans.**

In 1888 Maj. Jones did not consider the river worthy of improvement, '89, 2592.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Jones, '89, 2592.

**NORTH RIVER, N. Y.—(See HUDSON RIVER.)****NORTHWEST RIVER, N. C.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 153.

**ENGINEER IN CHARGE.**

Capt. G. J. Fiebeger, 1891. Report, '91, 1321.

**ASSISTANT.**

J. P. White. Report, '91, 1323.

**NORTHWEST RIVER, N. C.—Continued.****Physical Characteristics.**

Description of the locality, '91, 1323.

**Plans.**

In 1891 Capt. Fiebeger did not consider the locality worthy of improvement, '91, 1322.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Fiebeger, '91, 1321.

**MAPS.**

'91, 1322.

**NORWALK HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 365.)

**Appropriations.**

1829-'87 .....	\$76, 080
1888 .....	* 28, 000, '88, 564.
1890 .....	4, 000, '90, 645.

Total ..... 108, 080

List of appropriations, '88, 564.

**Contracts.**

1889. A. J. Beardsley &amp; Son, for dredging, at 11 cents and 15 cents per cubic yard, '89, 708.

1891. G. B. Beardsley, for dredging, at 14.6 cents per cubic yard, '91, 787.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 51; '89, 64; '90, 57; '91, 71; '92, 75.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886-'—. Reports, '88, 562; '89, 705; '90, 643; '91, 786; '92, 692.

**Operations.**

1887-'88. No operations, '88, 563.

1888-'89. 122,332 cubic yards material dredged from the channel, '89, 706.

1889-'90. 95,591 cubic yards material dredged, '90, 644.

1890-'91. No operations, '91, 787.

1891-'92. 28,000 cubic yards material dredged, '92, 693.

**Physical Characteristics.**

Description of the harbor, '88, 562.

**Projects.**

The project of 1872 proposed the formation of a channel, by dredging, 100 feet wide and 6 feet deep from the mouth of the river to the Stone Bridge in Norwalk, at an estimated cost of \$34,000, '72, 902.

In 1881 the project was modified to admit of a depth of 8 feet below South Norwalk, '81, 609. From 1872 to 1886, inclusive, \$76,000 was appropriated, when, in 1886, it was estimated that \$7,000 would be required to complete project, '86, 650.

By Col. Houston, 1888, for dredging the lower channel up to Wilsons Point to 15 feet depth and 300 feet width; estimated cost, \$52,900, '89, 64, 707. In consequence of the large amount of dredging done by private and corporate enterprise the cost of this project was reduced to an estimate of \$4,000 for completion in 1889, '89, 707.

**Surveys.****MAPS.**

'89, 708.

**NOTTOWAY RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 365.)

**Appropriations.**

1880-'81 ..... \$7, 000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 103; '91, 153.

\*Part of an appropriation of \$28,000, of which \$25,000 was required to be expended at Wilsons Point, '92, 694.

**NOTTOWAY RIVER, VA.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Col. W. P. Craigbill, 1888-'91. Report, '88, 773.

Capt. G. J. Fiebeger, 1891-'—, Report, '91, 1315.

Capt. C. B. Phillips, 1891-'—, Report, '91, 1318.

**ASSISTANT.**

W. G. Williamson. Report, '91, 1319.

**Operations.**

1887-'88. No operations since 1882, '88, 773.

**Plans.**

By Capt. Fiebeger, 1890, for improvement of the river between Courtland and its mouth by removal of obstructions and dredging, giving a channel from 7 to 8 feet deep for a distance of 15 miles from its mouth, and above that point a channel 2 to 3 feet deep at its lowest stage for a distance of 50 miles from its mouth; estimated cost, \$9,000, '91, 1316.

**Projects.**

By Capt. Phillips, 1878, for the formation of a channel not less than 60 feet wide and 9 feet deep from the mouth to railroad bridge, and thence to Peters Bridge, 50 miles above the mouth, 2 feet deep by the removal of logs, snags, and sunken vessels; estimated cost, \$9,000, '79, 720, 722; '80, 823.

In 1887 Capt. Hinman considered that there was no demand for the completion of the project, '87, 988.

**Surveys.**

Examination from the mouth to Courtland ordered by act of September 19, 1890.

Made, 1890, under direction of Capt. Fiebeger, '91, 1316.

**NOXUBEE RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 366.)

**Appropriations.**

1880-'87 .....	\$45,000
1888 .....	5,000, '88, 1210.
1890 .....	3,000, '90, 1705.
1892 .....	3,000, '92, 1453.

Total ..... 56,000

List of appropriations, '88, 1209.

**Commerce.**

Reduction in freight charges estimated to follow improvement of the river, '88, 1210.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 163; '89, 190; '90, 171; '91, 217; '92, 210.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1879-'—. Reports, '88, 1208; '89, 1441; '90, 1704; '91, 1787; '92, 1452.

**Operations.**

1887-'88. 4,108 logs, trees, and stumps removed from the channel, and 4,300 trees cut from the banks, clearing 35 miles of river, '88, 1209.

1888-'89. 4,280 snags and logs removed from the channel; 1,174 trees and logs cleared from the banks, '89, 1442.

1889-'90. 2,019 snags and logs removed from the channel; 456 trees and logs removed from the banks, '90, 1705.

1890-'92. No operations; project completed, '91, 1788; '92, 1452.

**Plans.**

In 1887 Maj. Damrell did not consider the river worthy of improvement by locks and dams, '87, 1343.

**Projects.**

By Maj. Damrell, 1880, for improvement of the river from Macon to its mouth, a distance of 69 miles, by removal of snags, logs, trees, and similar obstructions to navigation; estimated cost, \$65,215, '80, 1093; '87, 1329, 1313.

Project completed in 1890 at a cost of \$53,000, '90, 1705. Estimated annual cost of maintenance of improvement, \$3,000, '91, 1787.

**OAKLAND HARBOR, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 367.)

**Appropriations.**

1874-'87 .....	\$934, 600
1888 .....	350, 000, '88, 2107.
1890 .....	250, 000, '90, 2889.
1892 .....	150, 000, '92, 2619.

Total ..... 1, 684, 600

List of appropriations, '92, 2618.

**Commerce.**

Annual commerce passing through the jetties from 1874 to 1891, '92, 2619.

**Contracts.**

1888. San Francisco Bridge Company, furnishing stone, at \$1.48 per ton, and laying up stone masonry, at 10 cents per square foot, '90, 2471.
1888. San Francisco Bridge Company, for dredging tidal basin, at 14.7 cents, and tidal canal, at 19.7 cents per cubic yard, '90, 2471.
1891. Pacific Coast Dredging and Reclamation Company, for dredging, at 14½ cents per cubic yard, '91, 2946. A. Boschke, for dredging, at 9½ cents per cubic yard, '91, 2946. G. Stone, for stone, at \$1.52 per ton, and dry masonry, at 11½ cents per square foot, '91, 2946. Ransome & Cushing, for concrete bridge pier construction, at \$4.90 per cubic yard for concrete and \$1.70 per cubic yard for excavation, '91, 2946. King Iron Bridge and Manufacturing Company, for steel highway drawbridge construction, at \$31,260, '91, 2947. San Francisco Bridge Company, for dredging, at 31½ cents per cubic yard, '92, 2620.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 290; '89, 344; '90, 310; '91, 388; '92, 365.

ENGINEERS IN CHARGE.

Col. G. H. Mendell, 1875—'. Reports, '88, 2105; '90, 2886; '91, 2943; '92, 2617.

Maj. W. H. H. Benyaurd, 1889. Report, '89, 2468.

**Operations.**

1887-'88. No operations, '88, 2106.

1888-'89. 126,548 cubic yards material dredged from tidal basin; 96,530 cubic yards excavated from tidal canal; 116,748 cubic yards material dredged from jetty channel; 3,954 tons stone delivered on south jetty; 15,489 square feet dry masonry laid, '89, 345, 2469.

1889-'90. 495,387 cubic yards material dredged from tidal basin; 5,446 tons stone placed in jetties; 25,197 square feet dry masonry laid, and 450,000 cubic yards material excavated from tidal canal, '90, 310, 2887.

1890-'91. 250,820 cubic yards material dredged from eastern end of canal, 3,552 tons of rubble stone delivered upon north jetty, and 30,101 square feet of masonry laid, '91, 2944.

1891-'92. 9,815 tons stone delivered upon north jetty, and 31,528 square feet of masonry laid; construction of concrete bridge piers and highway bridge completed; 142,088 cubic yards material dredged, '92, 2618.

**Projects.**

By Board of Engineers, 1874, to secure a ship-channel entrance 18 to 20 feet deep at low water by the construction of two training walls extending from the shore to deep water in San Francisco Bay, the formation of a tidal basin at the head of the harbor, and the connection by a canal of the Oakland Estuary with that of San Leandro for the purpose of increasing the tidal basin; estimated cost, \$1,814,529, '74, ii, 382, 383.

Subsequent development of Oakland commerce necessitated the excavation of a channel between the jetties, and an extension of the deep-water channel along the water front of Oakland. The width of the Oakland Estuary and the San Leandro Canal was also increased from 300 to 400 feet, '86, 1907, 1908. In 1887 Col. Mendell estimated \$1,590,074 as the amount required for completion of the revised project, '87, 2422.

**OAK ORCHARD HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 368.)

**Appropriations.**

1836-'87 .....	\$191, 000
1888 .....	6, 000, '88, 2064.
1890 .....	5, 000, '90, 2848.

Total ..... 205, 000

**OAK ORCHARD HARBOR, N. Y.—Continued.****Contracts.**

1888. McCollum & Lee, for dredging, at 50 cents per cubic yard, '89, 2406.  
 1891. Hingston & Woods, for rock excavation, at \$1.40 per cubic yard, and sand, clay, and gravel, at 34 cents per cubic yard, '91, 2897.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 281; '89, 333; '90, 301; '91, 377; '92, 356.

**ENGINEERS IN CHARGE.**

Capt. F. A. Mahan, 1886-'90. Reports, '88, 2062; '89, 2403.

Maj. A. Stickney, 1890-'92. Reports, '90, 2847; '91, 2896.

Maj. E. H. Ruffner, 1892-'— Report, '92, 2537.

**Operations.**

1887-'88. East pier rebuilt by hired labor, '88, 2063.

1888-'89. 91 linear feet of timber and stone shore protection built, '89, 2405.

1889-'90. 10,230 cubic yards of material dredged from channel, and slight repairs made to east pier, '90, 2847.

1890-'91. No operations, '91, 2896.

1891-'92. 3,388 cubic yards of material dredged, '92, 2538.

**Physical Characteristics.**

Description of the locality, '88, 2063.

**Projects.**

From 1836 to 1880, inclusive, \$173,500 was appropriated and applied to the extension of two piers, dredging in the channel between the piers, and in repairs, '74, i, 343; '76, ii, 579; '80, 2206.

In 1881 Lieut. Col. McFarland proposed the further extension of both lines of pier 500 feet, or to the 12-foot curve in Lake Ontario, deepening the channel between the piers to 12 feet by dredging; estimated cost, \$100,000, '81, 2435.

**OBEILS RIVER.—FROM THE POINT WHERE IMPROVEMENTS HAVE HERETOFORE BEEN MADE TO THE MOUTH OF THE WEST FORK, TENN.**

(Continued from Vol. II, p. 368.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 213.

**ENGINEER IN CHARGE.**

Lieut. Col. J. W. Barlow, 1886-'—. Report, '88, 1636.

**ASSISTANTS.**

W. C. Crozer. Report, '88, 1637.

**Physical Characteristics.**

Description of the locality, '88, 1636.

**Plans.**

By Lieut. Col. Barlow, 1887, for clearing 15 miles of river by dredging, removal of overhanging trees, rock, and snags, and riprap dam construction; estimated cost, \$4,352, '88, 1638.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Barlow, '88, 1636.

**OBION RIVER, TENN.—SURVEY OF.**

(Continued from Vol. II, p. 369.)

**Appropriations.**

1892..... \$7,500

**Commerce.**

Commercial interests of the locality, '91, 2294.

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 285.

**ENGINEER IN CHARGE.**

Lieut. Col. J. W. Barlow, 1890. Report, '91, 2292, 2296.

**ASSISTANT.**

B. B. Smith. Report, '91, 2293, 2297.

**OBION RIVER, TENN.—Continued.****Physical Characteristics.**

Description of the locality, '91, 2296.

**Plans.**

By Lieut. Col. Barlow, 1891, for improvement of the river from its mouth to the crossing of the Louisville and Memphis Railroad in Obion County by snagging and wing-dam construction, giving a channel of not less than 3 feet depth at the lowest stages; estimated cost, \$50,000, '91, 2297.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Barlow, '91, 2297.

**OCCOHANNOCK RIVER, VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 112.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1888. Report, '89, 913.

ASSISTANT.

A. Stierle. Report, '89, 914.

**Physical Characteristics.**

Description of the locality, '89, 914.

**Plans.**

In 1889 Col. Craighill did not consider the river worthy of improvement, '89, 913.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of W. F. Smith, '89, 913.

**OCCOQUAN CREEK, VA.—IMPROVEMENT OF.****Appropriations.**

1873-'87 .....	\$25,000
1890 .....	10,000, '91, 1255.
1892 .....	5,000, '92, 1042.

Total .....	40,000
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**Contracts.**

1891. D. McConville, for dredging, at 10½ cents for material dredged and deposited, measured in place, and 14½ cents for material measured in scows, '91, 1255.

1892. F. L. Somers, for dredging, at 22 cents per cubic yard, '92, 1041.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 135; '90, 121; '91, 138; '92, 139.

ENGINEERS IN CHARGE.

S. T. Abert, U. S. agent, 1888-'91. Report, '90, 1089, 1091.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1253.

Maj. C. E. L. B. Davis, 1892-'— . Report, '92, 1039.

**Operations.**

1890-'91. 36,640 cubic yards material dredged, '91, 1255.

1891-'92. 20,967 cubic yards material dredged, '92, 1041.

**Physical Characteristics.**

Description of the locality, '90, 1092.

**Plans.**

By S. T. Abert, 1890, for the excavation of an 8-foot channel through Occoquan and Upper and Lower Mud bars with 4,450 linear feet of brush and pile mattress dike construction; estimated cost, \$91,250, '90, 1095.

**Projects.**

By Lieut. Col. Hains, 1890, for excavation of a channel 100 feet wide and 6 feet deep at Lower and Upper Mud, and at Sand and Occoquan bars; the channel to be maintained at the two latter localities by sheet pile dike construction; estimated cost, \$45,000, '91, 1254.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Mr. S. T. Abert, '90, 1091:



**OCKLAWAHA RIVER, FLA.—IMPROVEMENT OF.****Appropriations.**

1835-'91 .....	\$35,000
1890.....	10,000, '91, 1621.
1892.....	1,000, '92, 1367.

Total ..... 46,000

**Commerce.**

Present and prospective commerce of the river, '91, 1626; '92, 1368.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 1360; '91, 186; '92, 183.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1888-'92. Reports, '89, 1360; '91, 1620.

Maj. J. C. Mallery, 1892-'— Report, '92, 1366.

**ASSISTANTS.**

Lieut. D. D. Gaillard. Report, '89, 1361.

J. H. Bacon. Report, '91, 1621.

**Operations.**

1891-'92, 3,880 snags removed from the channel, and 705 trees cleared from the banks, '92, 1367.

**Physical Characteristics.**

Description of locality, '89, 1360.

Table of distances, '91, 1623.

**Plans.**

By Capt. Black, 1889, for a 3-foot channel from the mouth to Lake Griffin, to be secured by the removal of snags, logs, and overhanging trees, and cutting off bends; estimated cost, \$50,000, '89, 1361.

**Projects.**

By Capt. Black, 1891, for clearing the channel between Lake Griffin and the mouth by removal of snags, overhanging trees, and floating drift; estimated cost, \$7,500, '91, 1620.

In 1892 Maj. Mallery recommended the extension of the improvement to Leesburg at the upper end of Lake Griffin, at an estimated cost of \$15,000, with an annual outlay for maintenance of entire improvement of \$1,000, '92, 1367.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Black, '89, 1360.

Survey made 1891, under direction of Capt. Black, '91, 1621.

**MAPS.**

'91, 1626.

**OCMULGEE RIVER, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 370.)

**Appropriations.**

1876-'87 .....	\$64,500
1888.....	15,000, '88, 1174.
1890.....	30,000, '91, 1547.
1892.....	25,000, '92, 1274.

Total ..... 134,500

List of appropriations, '88, 1173.

**Commerce.**

Reduction in freight rates consequent upon improvement, '89, 1257.

Commerce of the river, '90, 1396, 1479; '92, 1273.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 155; '89, 162, 164; '90, 145, 147; '91, 182; '92, 178.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1173.

Lieut. O. M. Carter, 1889-'— Reports, '89, 1256; '90, 1396, 1455; '91, 1543; '92, 1271.

**ASSISTANTS.**

F. C. Armstrong. Reports, '89, 1258; '90, 1400; '91, 1548; '92, 1274.

J. L. Van Orum. Report, '90, 1462.

**OCMULGEE RIVER, GA.—Continued.****Operations.**

1887-'88. No operations. '88, 1174.

1888-'89. 886 logs and snags removed from the river channel, and 4,500 trees and logs cleared from the banks, '89, 1257.

1889-'90. 1,956 snags and logs removed from the channel, and 8,323 logs and trees cleared from the banks, '90, 1396.

1890-'91. 186 snags removed from the channel, and 9,409 trees cleared from the banks; dam construction and repair of Tillmans Bar, '91, 1514.

1891-'92. 2,902 snags removed from the channel, and 6,756 trees cleared from the banks, '91, 1272.

**Physical Characteristics.**

Description of the river, '89, 1258, 1259; '90, 1455.

**Private and Corporate Work.**

\$60,000 expended by State of Georgia in improvement of Ocmulgee River, '88, 1174; '89, 1257.

**Projects.**

For description of prior projects and improvements see '89, 1258.

By Capt. King, 1877, for formation of a channel 80 feet wide and with a low-water depth of 4 feet from Macon to the mouth by removal of sand and gravel bars, rock reefs, snags, trees, and similar obstructions; estimated cost, \$56,240, '87, 91, 600; '82, 1276.

The estimated cost was increased in 1882, 1885, and 1886 to \$112,480, '82, 1859; '85, 1297; '86, 1160; '87, 1276.

By Lieut. Carter, 1890, for the establishment of a navigable steamboat channel 3 feet deep at ordinary summer low water from Macon to the river's mouth; this to be obtained by (1) removal of rock shoals and sand bars; (2) closing incipient cut-offs and revetting caving banks, (3) removal of snags and logs from the channel and overhanging trees from the banks; estimated cost, \$210,000, '90, 1395; '91, 1514.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Lieut. Carter, '90, 1458.

**OCONEE RIVER, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 371.)

**Appropriations.**

1878-'87 .....	\$32,500
1888 .....	12,500, '88, 1172.
1890 .....	25,000, '90, 1391.
1892 .....	25,000, '92, 1268.

Total ..... 95,000

List of appropriations, '88, 1171.

**Commerce.**

Reduction in freight rates since commencement of improvement, '91, 1539; '92, 1267.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 154; '89, 161, 164; '90, 144, 147; '91, 181; '92, 178.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1170.

Capt. O. M. Carter, 1889-'—. Reports, '89, 1250; '90, 1388, 1430, 1432; '91, 1536; '92, 1265.

**ASSISTANTS.**

F. C. Armstrong. Reports, '89, 1253; '90, 1392; '91, 1541; '92, 1269.

A. S. Cooper. Report, '90, 1436.

**Operations.**

1887-'88. 256 snags and 105 cubic yards loose rock removed from the channel, and 691 overhanging trees from banks, '88, 1172.

1888-'89. 920 logs, snags, and stumps removed from the channel, and 952 trees cut from the banks, '89, 1251.

1889-'90. 918 snags, 358 stumps, and 15,220 trees removed from the channel and banks, '90, 1392.

**OCONEE RIVER, GA.—Continued.****Operations—Continued.**

1890-'91. 893 snags, 200 stumps, 146 overhanging trees, and 42 logs cleared from the channel; 600 cubic yards of stone quarried and placed in closing dam, '91, 1537, 1538.

1891-'92. 571 snags and 366 cords of drift removed from the channel, and 16,910 trees and logs cleared from the banks; construction of brush and pile dams in progress, '92, 1267.

**Physical Characteristics.**

Description of the river, '89, 1253; '90, 1430, 1432, 1437, 1444.

**Private and Corporate Work.**

Appropriations for improvement of the river made by State of Georgia and private companies, '89, 1253, 1254.

**Projects.**

By Maj. King, 1878, for both the prevention and formation of cut-offs, removal of snags and logs, and cutting through rock reefs where necessary, so as to secure a 3-foot low-water navigation from the mouth of the river to Milledgeville, '78, 105, 768.

From 1878 to 1886, inclusive, \$36,500 was appropriated, when it was estimated that \$17,500 would be required to complete the project, '86, 1162.

By Capt. Carter, 1890, for the establishment of a navigable steamboat channel 3 feet deep at ordinary summer low water from Milledgeville to the river's mouth; this to be accomplished by (1) removing rafts, rock shoals, and sand bars; (2) enlarging portions of the river, revetting caving banks, and closing incipient cut-offs; (3) removing snags and logs from the channel, and overhanging trees from the banks of the stream; estimated cost, \$171,000, '90, 1389; '91, 1537.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Capt. Carter, '90, 1432.

**OCONTO HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 372.)

**Appropriations.**

1881-'87 .....	\$48,000
1888 .....	20,000, '88, 1841.
1892 .....	3,000, '92, 2178.

Total ..... 71,000

List of appropriations, '92, 2178.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 237; '89, 286; '90, 249; '91, 319; '92, 303.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1839; '89, 2046, 2106; '90, 2330; '91, 2531.

Maj. J. B. Gregory, 1892-'— Report, '92, 2177.

**Operations.**

1887-'88. 1,200 feet of reenforcement piling on channel side of south pier built by hired labor, '88, 1839.

1888-'89. 650 linear feet of channel side of south pier reenforced with piling; 600 linear feet of opposite side of pier provided with riprap; minor repairs to north pier by hired labor, '89, 2046.

1889-'90. 197,715 cubic yards material dredged; repairs to dredging plant; repairs to north and south piers by hired labor, '90, 2331.

1890-'91. No operations, '91, 2531.

1891-'92. Repairs to north pier, '92, 2177.

**Plans.**

By Maj. Davis, 1888, for excavation of a channel 16 feet deep and 75 feet wide from the piers up to Spies' Mills, a distance of 6,000 feet; extension of the south pier 1,100 feet, and reconstruction and extension of north pier 1,900 feet; estimated cost, \$181,000, '89, 2107.

**OCONTO HARBOR, WIS.—Continued.****Projects.**

By Lieut. Col. Robert, 1881, for extension of slab piers to 10-foot curve by construction of 4,000 linear feet of slab pier and 500 linear feet of crib pier; dredging a channel from the entrance to Oconto, having a width of 100 feet and a depth of 8 feet with 10 feet at entrance; estimated cost, \$125,000, '81, 2067. Revised in 1883, after a resurvey of locality, to \$150,000, '83, 1646; '87, 2007.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Davis, '89, 2106.

**MAPS.**

'88, 1840.

**OCBACOCKE INLET, N. C.—IMPROVEMENT OF.****Appropriations.**

1826-'89 .....	\$133, 750
1890 .....	90, 000, '91, 1342.
1892 .....	15, 000, '92, 1116.

Total ..... 238, 750

**Commerce.**

Commercial interests of the locality, '89, 1120; '91, 1344.

**Contracts.**

1891. Alabama Dredging and Jetty Company, for dredging, at 17 cents per cubic yard, '92, 1117.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 148; '91, 156; '92, 157.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1888-'92. Reports, '89, 1118; '91, 1341.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1115.

**ASSISTANT.**

Lieut. M. M. Patrick. Report, '91, 1342.

**Physical Characteristics.**

Description of the locality, '89, 1119.

**Plans.**

By Capt. W. H. Bixby, 1889, for improvement of the inlet to form a direct ocean outlet for the commerce of Albemarle and Pamlico sounds by dredging a channel 300 feet wide and from 10 to 15 feet deep through the southern bar passage (called Portsmouth Straightway), and deepening its southern inside channel; also to dredge an inlet to a harbor of refuge; estimated cost of dredging for a 10-foot depth, \$100,000; for a 15-foot depth, \$280,000. Also for construction (if necessary) of training and protecting dikes, at a cost of \$320,000; total estimated cost for dredging and diking, \$600,000, '89, 1123, 1124; '91, 1341.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1118.

Survey made, 1891, under direction of Capt. Bixby, '91, 1342.

**MAPS.**

'91, 1344; '92, Atlas, 21.

**OGDENSBURG HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 373.)

**Appropriations.**

1852-'87 .....	\$145, 005. 56
1888 .....	15, 000. 00, '88, 2091.
1890 .....	42, 000. 00, '90, 2872.
1892 .....	40, 000. 00, '92, 2602.

Total ..... 242, 005. 56

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 285; '89, 338; '90, 305; '91, 383; '92, 362.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1885-'—. Reports, '88, 2089; '89, 2440; '90, 2871; '91, 2923; '92, 2601.

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**OGDENSBURG HARBOR, N. Y.—Continued.****Operations.**

- 1878-'88. Excavation continued in channel along city front, '88, 2090.  
 1888-'89. No operations, '89, 2441.  
 1889-'90. Dredging in the harbor resumed, '90, 2872.  
 1890-'91. Dredging in progress, '91, 2924.  
 1891-'92. 108,455 cubic yards of material dredged, and 9,286 cubic yards of hardpan removed, '92, 2602.

**Projects.**

The project for the improvement of this harbor was adopted in 1867-'68, and proposed the deepening, by dredging, of the Oswegatchie River below the bridge, and also the Saint Lawrence River along the city front to a depth of 12 feet, and the construction of 2 dikes, if found necessary, to direct the river currents, '68, 257, 270.

From 1851 to 1881, inclusive, \$110,005.56 was appropriated, '82, 2461.

In 1882 the project was modified so as to provide for a depth of 15 feet in the Oswegatchie and Saint Lawrence channels and 16 feet depth on the outer bar; estimated cost, \$76,000, '82, 2461; '85, 2294. Increased in 1885 to \$108,000, '85, 2295; '87, 2394.

In 1890 Maj. Adams proposed to afford 16.5 feet in all the channels, involving the removal of 362,000 cubic yards of hardpan and solid rock, at an estimated cost of \$158,950, '90, 2872; '92, 2602.

**OHIO RIVER, except the Falls and the Louisville and Portland Canal.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 374.)

**Appropriations.**

1835-'87 .....	\$4, 301, 914. 25	
1888 { Improvement of Ohio River .....	380, 000. 00	} '88, 1666.
{ Ohio River below Pittsburg to defray expenses of		
{ Board of Engineers .....	10, 000. 00	
1890 .....	360, 000. 00	'90, 2179.
	* 250, 000. 00	'91, 2355.
	360, 000. 00	'92, 1973.
1892 .....	* 100, 000. 00	'92, 1984.
Total .....	5, 701, 914. 25	

List of appropriations, '92, 1960.

**Commerce.**

- River commerce of Cincinnati for 1887-'88, '88, 1668.  
 River commerce of Cincinnati for 1888-'89, '89, 1666.  
 Commerce passing the Falls of the Ohio from 1880 to 1888, '88, 1670; '90, 2183.  
 Present condition of Ohio River commerce, '91, 2339.  
 Coal shipments from Pittsburg for 1890, '91, 2345.  
 River commerce of Cincinnati for 1890, '91, 2346.  
 Comparative statement of commerce passing the Falls of the Ohio River by canal and by river from 1882 to 1891, '91, 2348; '92, 1976.  
 Commerce of the Ohio for 1890, '91, 2348.  
 Ohio River commerce for 1892, '92, 1973, 1977.  
 Coal shipments from Pittsburg for 1891, '92, 1974.  
 River commerce of Cincinnati for 1891, '92, 1975.

**Contracts.**

1888. S. D. Davis, for hire of tow boat, at \$45 per day, '89, 1862.  
 1889. Ella Layman Towboat Company, for towboat hire, at \$33.80 per day; O. Reed, for dam construction, at \$6,761; J. T. Hart, for dam construction, at \$8,629; J. J. Shipman, for dike construction, at \$14,978; J. J. Shipman, for dike construction, at \$16,868; W. Kirk, for dike construction, at \$12,595; W. Kirk, for dike construction, at \$25,453; Ohio and Mississippi Railroad Company, for earth filling, at 20 cents per cubic yard; H. S. Brown, for rock removal, at \$1.10 per ton; J. F. King, for rock removal, at \$3.97 per cubic yard, '89, 1862-1865. B. R. Harsha & Co., for paving embankment, at \$9.13 per square foot; J. Shipman, for ice-pier construction, at \$3,798; J. W. Scott & Co., for embankment extension, at 21 cents per cubic yard, '90, 2180.

\*For construction of movable dam in Ohio River near the mouth of Beaver River, Pa., '91, 2355; '92, 1984.

**OHIO RIVER, except the Falls and the Louisville and Portland Canal—Continued.****Contracts—Continued.**

1891. J. C. Graham, for crib superstructure construction, at \$6,572; Richardson & Monroe, for dam construction, at \$21,685; J. J. Shipman, for dike construction, at \$19,850, '91, 2341. J. J. Shipman, for dike construction, at \$15,580; Wm. Kirk, for crib superstructure construction, at \$10,975; Wm. Kirk, for dike construction, at \$25,080; V. P. Collins, for towboat hire, at \$13.44 per day, '91, 2342. Ohio and Mississippi River Company, for raising roadbed, at \$8,611; S. W. Coffin & Son, for construction of two dump scows, at \$3,537 per scow; J. Johnson, for embankment extension, at \$7,310; Ohio and Mississippi Railroad Company, for delivery of earth on embankment, at \$2,862.50, '91, 2343. J. R. Ware, for ice-pier construction, at \$3,747; J. R. Ware, for ice-pier construction, at \$4,289; J. R. Ware, for ice-pier construction, at \$4,526; S. D. Davis, for hire of steamboat, at \$43 per day, '91, 2344. J. Short, for riprapping levee, at \$1.50 per cubic yard, '92, 1973.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 213, 214; '89, 248, 250, 1868; '90, 224, 226; '91, 288, 290; '92, 275, 277, 278.

**BOARD OF ENGINEERS.**

Convened at Pittsburg, September 7, 1888, by S. O. No. 41, to examine and report upon the improvement of the Ohio River below Pittsburg by means of movable dams. Report, '88, 1869. (Lieut. Col. Merrill and Majs. Stickney and Mackenzie.)

**ENGINEERS IN CHARGE.**

Lieut. Col. W. E. Merrill, 1870-'92. Reports, '88, 1645, 1656, 1670; '89, 1851, 1873; '90, 2163, 2183, 2186; '91, 2328, 2334, 2349, 2350, 2354.

Maj. A. Stickney, 1892-'— Reports, '92, 1960, 1978, 1980, 1983.

**ASSISTANTS.**

P. Golay. Report, '88, 1644.

W. Martin. Reports, '88, 1673; '89, 1876; '90, 2188; '91, 2352; '92, 1981.

E. J. Carpenter. Reports, '90, 2184; '91, 2333; '92, 1964.

Capt. W. H. Christian. Report, '92, 1979.

**Obstructions.**

List of bridges over the Ohio River, '88, 1659.

List of losses by collision with piers of Ohio River bridges from 1862 to 1888, '88, 1660; '89, 2175.

Losses by collision with bridges during 1891, '91, 2337. During 1892, '92, 1971.

**Operations.**

1887-'88. Dam at Three Brothers Island repaved; 276 linear feet substructure and 578 linear feet of superstructure built at Gravel Chain Diike; 11,472 tons rock blasted and removed at Grand Chain, '88, 1644. 1,384 cubic yards rock removed at mouth of Licking River; 64,500 cubic yards material placed in Great Miami Embankment, '88, 1647. 147,808 cubic yards gravel, shell, loose rock, etc., removed at Davis Island Dam, Wheeling Creek Bar, Three Brothers Island, and Rowlands Race; also 12 rocks, 60 logs and snags, and 3 wrecks, '88, 1649. Snagging operations; 1,225 snags, 127 rocks, and 46 wrecks removed, '88, 1651. Third dike at Four Mile Bar completed, '88, 1652. Operation and care of Davis Island Dam, '88, 1670.

1888-'89. Construction of drift gap begun in Davis Island Dam, '89, 1852. Repairs to dike at trap below Pittsburg; 1,500 cubic yards riprap placed in Marietta Island Dam; 150 linear feet of crib dike built at Eight Mile Island; 300 linear feet of dike built at Bonanza Bar; 200 linear feet of dike completed at Madison; construction of dike at Caseyville begun, '89, 1853. Middle dike at Grand Chain extended 1,848 feet; construction of ice piers at Pomeroy, Middleport, and Gallipolis begun; ice pier at Ironton completed, '89, 1854. 45,781 cubic yards material dredged; 15 rocks and 8 wrecks removed, '89, 1857. 329 snags and 24 wrecks removed in the course of snagging operations, '89, 1859. Operation and care of Davis Island Dam, '89, 1873.

1889-'90. Drift gap at Davis Island Dam completed; 500 linear feet of timber and stone dam completed between Davis and Neville islands; construction of dam at Marietta Island continued, '90, 2164. 1,846 linear feet of dike built at Eight Mile Island; construction of dike at Bonanza Bar continued; dike at Madison completed for a length of 1,600 feet; dike at Caseyville completed for a length of 2,450 feet, '90, 2165. Operations on middle dike at Grand Chain continued; 5,938 tons rock removed from bar at mouth of Licking River, '90, 2166. Ice piers completed at Pomeroy, Middleport, and Gallipolis; Shawneetown Embankment completed, '90, 2167. 121,460 cubic yards material dredged from the river, '90, 2171. Operation and care of Davis Island Dam, '90, 2186.

**OHIO RIVER, except the Falls and the Louisville and Portland Canal—Continued.****Operations—Continued.**

1890-'91. Ends of dam between Davis and Neville islands straightened by crib work; repairs to timber and filling of dike at the Trap, '91, 2328. Dam at Marietta Island completed; 700 linear feet of abutment completed at Blennerhasset Island Dam; construction of dam at Eight Mile Island completed; dike completed at Bonanza Bar, '91, 2329. 670 linear feet of dike completed at Cullom; 400 linear feet of piling driven in construction of dike at lower bar, Rising Sun; 2,250 linear feet of Madison Dike substructure completed; 950 linear feet of dike completed at Flint Island; dike at Caseyville completed, '91, 2330. Two-thirds of total proposed dike at middle of Grand Chain completed, '91, 2331. Three sections of ice pier at Portsmouth completed; embankment strengthened at Shawneetown; 450 cubic yards rock removed from channel of Big Hocking River, '91, 2332. 10,772 cubic yards material dredged at Marietta Island, Harmar, and Blennerhasset Island, '91, 2334. 204 snags and 17 wrecks removed by snag boat, '91, 2349. Operation and care of Davis Island Dam, '91, 2350.

1891-'92. Repairs to dam between Davis and Neville islands; repairs to dam at Marietta Island; crest of dike at foot of Marietta Island raised; reconstruction of dam at head of Blennerhasset Island completed; dike completed at Eight Mile; dike at Culloms completed; dike at lower bar, Rising Sun, completed, '92, 1961. Dike at Madison nearly finished; dike at Flint Island completed; 2,235 cubic yards rock removed from rock bar at the mouth of Licking River, '92, 1962. Fourth section of ice pier at Portsmouth completed, and ice pier built at Ripley; 19,640 cubic yards material placed in Great Miami Embankment, '92, 1963. Exposed faces of levee at Shawneetown riprapped and paved; 627 cubic yards stone and 48 logs removed from Big Hocking River; 81,564 cubic yards gravel and sand, 23,232 cubic yards rock and stone, 6 wrecks, and 171 piles removed from the river at various points, '92, 1964, 1966. 473 snags and 34 wrecks removed by snag boat, '92, 1979. Operation and care of Davis Island Dam, '92, 1980.

**Physical Characteristics.**

1888. Gauge records, '88, 1653.

Slope of the Ohio at low water, '88, 1653.

Gauge readings for 1891 and 1892 at Davis Island Dam, Cincinnati, and Evansville, '92, 1970.

**Projects.**

The early projects for the improvement of the Ohio River were directed toward obtaining a minimum low water of 2½ feet, '66, iii, 25, iv, 244, 246, 259, 261, 271. As the commercial requirements of the river increased the necessity for a greater low-water depth became apparent, '73, 499.

In 1874 Maj. Merrill proposed the radical improvement of the river above the Falls so as to secure a minimum depth of 6 feet by means of movable dams, '74, i, 64, 406, 410. (See also Index to Reports of the Chief of Engineers, Vol. I, p. 390.)

The general method of improvement has been to remove snags and rocks, to close up duplicate channels by low dams, to hold up and guide the water by dikes where the river had an excessive width, and to remove, by dredging, hard bars and projecting points, '84, 261.

The radical improvement of the river so as to secure a low-water depth of 6 feet was commenced in 1878 by the construction of the Davis Island Dam, '79, 143, 1299, which was opened to navigation in 1885, '86, 1528. The cost of this work was about \$910,000, '86, 271.

The total amount appropriated from 1827 to 1886, inclusive, was \$4,443,479.25, including \$75,000 from the appropriations of 1880 and 1881 for improving Indiana Channel.

In 1888 Lieut. Col. Merrill proposed the erection of 2 additional movable dams, the continuation of low dam and dike construction, the removal of obstructions in the mouth of the Licking, with snagging and dredging; estimated cost, \$1,051,500, '88, 1668.

In 1888 the Board of Engineers recommended the extension of the slack-water system of improvement to a point 25 miles below Pittsburgh by the construction of 4 additional movable dams at Merrimans Bar, at the Trap, near Economy, and just below the mouth of Beaver River; estimated cost, \$3,600,000, with an annual cost of \$26,000 for maintenance, '89, 1869, 1873.

**Surveys.**

Survey for location of movable dam in Ohio River below the mouth of Beaver River, Pa. Made, 1891, under direction of Maj. Stickney, '92, 1983.

**MAPS.**

'88, 1648, 1652; '89, 1872; '90, 2166, 2178; '92, Atlas, 91, 92, 93.

**OHIO RIVER, Falls of.**—(INCLUDING THE LOUISVILLE AND PORTLAND CANAL AND INDIANA CHUTE.)

(Continued from Vol. II, p. 377.)

**Appropriations.**

1852-'57.....	\$3,594,657.91
1888 { Falls of Ohio River, including L. and P. Canal..	150,000.00, '88, 1724.
{ Indiana Chute Falls.....	15,000.00, '88, 1727.
1890 { Falls of Ohio River, including L. and P. Canal..	60,000.00, '90, 2212.
{ Indiana Chute Falls.....	25,000.00, '90, 2215.
1891. Relief act.....	2,128.87
1892 { Falls of Ohio River, including L. and P. Canal..	60,000.00, '92, 2018.
{ Indiana Chute Falls.....	35,000.00, '92, 2022.
Total.....	3,941,786.78

**Commerce.**

1887-'88. Commerce passing through the canal, '88, 1735.  
 1888-'89. Commerce passing through the canal, '89, 1919, 1927.  
 1889-'90. Commerce passing through the canal, '90, 2228.  
 1890-'91. Commerce passing through the canal, '91, 2401.  
 1891-'92. Commerce passing through the canal, '92, 2030.

**Contracts.**

1888. P. H. Sweeney, for gravel and rock revetment, at 74½ cents and \$1.20 per cubic yard; Peaslee, Gaulber & Co., for axle grease, at 5 cents per box; A. H. Dugan, for coal, at \$4.622; M. Nippert & Co., for manila rope, at \$445.62; B. B. Connor, for forage, at \$215.40; Locke & Jacquemine, for ice, at \$60, '88, 1731, 1732.  
 1889. A. H. Dugan, for coal, at \$4,318.50; G. Becker, for forage, at \$177.25, '89, 1923, 1924.  
 1890. A. H. Dugan, for coal, at \$4,316.50; G. Becker and S. Bellville, for forage, at \$186.50, '90, 2224.  
 1891. Salem Stone and Lime Company, for stone, at \$7.40 and \$8 per cubic yard, '91, 2390. B. S. Connor, for forage, at \$290.50; A. H. Dugan, for coal, at \$4,375, '91, 2398.  
 1892. G. Becker & Co., for forage, at \$259.90, '92, 2027. A. H. Dugan, for coal, at \$6,085, '92, 2028.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 218, 219; '89, 254, 255, 256; '90, 229, 230; '91, 295, 296; '92, 283, 284.

**BOARD OF ENGINEERS.**

Convened at Louisville, Ky., January 28, 1890, by S. O. No. 68, to examine and report upon revised project for the improvement of Indiana Chute and the Falls of the Ohio at the head of the Louisville and Portland Canal. Report, '90, 2217. (Lieut. Col. Merrill and Majs. Stickney and Mackenzie.)

**ENGINEERS IN CHARGE.**

Maj. A. Stickney, 1886-'90. Reports, '88, 1723, 1727, 1728; '89, 1913, 1917, 1920.

Capt. E. Maguire, 1890-'91. Report, '90, 2211, 2215, 2221.

Lieut. Col. G. J. Lydecker, 1891-'—. Reports, '91, 2387, 2393, 2394; '92, 2015, 2020, 2024.

**ASSISTANTS.**

J. P. Claybrook. Report, '88, 1726.

G. W. Shaw. Reports, '88, 1727; '89, 1915, 1918; '90, 2212, 2216; '91, 2391; '92, 2020, 2022.

T. H. Taylor. Report, '88, 1733.

R. R. Jones. Reports, '89, 1916, 1924; '90, 2213, 2225; '91, 2391, 2399; '92, 2018, 2028.

**Operations.**

1887-'88. 49,883 cubic yards solid rock, 195 cubic yards loose rock, 1,908 cubic yards dry wall, and 9,185 cubic yards earth excavated in enlargement of upper portion of Louisville and Portland Canal; 4,928 cubic yards masonry laid in new canal wall; 42,549 cubic yards earth and 3,234 cubic yards rock excavated from basin at head of locks; construction and repair of plant, '88, 1726. Removal of rock reef and repairs to cross dam and guiding dike at Indiana Chute, '88, 1728. Operation and care of canal, '88, 1728, 1733.

1888-'89. 2,491 cubic yards earth excavated in canal enlargement; purchase and construction of plant, '89, 1916. 7,682 cubic yards earth excavated in enlargement of canal basin, '89, 1917. Operation and care of canal, '89, 1920.

1889-'90. 12,998 cubic yards rock excavated in enlargement of canal basin; 1,585 cubic yards stone taken from old wall and built into new canal basin wall, '90, 2214, 2215. Operation and care of canal, '90, 2221.



**OHIO RIVER, Falls of—Continued.****Operations—Continued.**

1890-'91. 3,784 cubic yards material and 171 cubic yards rock excavated in enlargement of canal basin above the locks, and 469 cubic yards of masonry built, '91, 2388. 8,072 cubic yards rock removed in enlargement of upper portion of canal, '91, 2389. Operation and care of Louisville and Portland Canal, '91, 2394.

1891-'92. 15,299 cubic yards earth and 42,856 cubic yards rock excavated in enlargement at head of canal, '92, 2016. 11,760 cubic yards earth and 3,364 cubic yards rock excavated in canal enlargement above the locks, and 3,704 cubic yards of masonry placed in new wall; 1,570 cubic yards rock removed from old canal wall, '92, 2017. Old guiding dike at Indiana Chute raised and repaired; cross dam repaired and rebuilt above water line; 1,474 cubic yards rock removed, '92, 2021. Operation and care of Louisville and Portland Canal, '92, 2024.

**Projects.**

A company chartered by the State of Kentucky to build and operate a canal with locks at Louisville began work in 1828, and opened the canal to traffic in 1830, at a cost of \$1,019,277, '66, iv, 264; '82, 1882.

By acts of Congress of May 13, 1826, and March 2, 1829, the United States became the owner of 2,335 shares of the stock of the company, at a cost of \$233,500.

Between 1868 and 1875, inclusive, \$1,463,200 was appropriated for the improvement of the Falls of the Ohio and applied to the enlargement of the canal and the improvement of the Indiana Chute.

In 1874 the Government assumed control of the canal, and on July 1, 1880, in accordance with the act of May 18, 1880, the canal was made free from all tolls. The summarized cost of the works stated as about \$4,800,000, '82, 1882, 1883.

The project was modified in 1893 to provide for the enlargement of the existing canal by moving its northern wall to the north limit of the canal property; the removing of the present guiding dike and cross dam; the construction of a dam along the easterly line of the Louisville Cement Company's property, and thence to the southern end of the opening for Middle Chute; estimated cost, \$1,335,363, '83, 1539; '85, 1812.

Indiana Chute: The object of this work was to render the channel over the Falls navigable for coal boats at all stages when they could reach Louisville, by widening the crooked and narrow channel by rock removal, and facilitating navigation by building guiding dikes. The amount appropriated for the work to June 30, 1887, was \$125,000; the estimated cost of completion, \$130,000, '87, 1483.

In 1890 the Board of Engineers recommended the excavation of the reduced area at the head of the canal, the extension of the bear-trap structures, and the construction of a dam parallel to the Kentucky shore, as planned by Maj. Stickney; also the continuation of excavations in Indiana Chute, the extension of the guiding dike upstream, and the elevation of the crib dike on north side of Indiana Chute; estimated cost of completing enlargement at head of Louisville and Portland Canal as recommended by the Board, \$710,230.40, and for completion of work at Indiana Chute, \$138,610.97, '90, 2218-2220; '91, 2390, 2393.

**OHIO RIVER near city of Evansville.—SURVEY OF.**

(Continued from Vol. II, p. 379.)

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 218; '91, 294.

ENGINEER IN CHARGE.

Lieut. Col. W. E. Merrill, 1887-'— Reports, '88, 1715, 1716; '91, 2382, 2383.

ASSISTANTS.

Lieut. L. Beach. Report, '88, 1715.

J. N. Caldwell. Reports, '88, 1718; '91, 2385.

**Physical Characteristics.**

• Description of the locality, '88, 1716.

**Plans.**

By Lieut. Col. Merrill, 1887, for preventing a change of the river channel in front of the city of Evansville by purchase of land, tree planting, and erection of wire fencing to serve as a barrier to catch drift and sediment, reducing the velocity of the overflow; estimated cost, \$49,000, '88, 1717; '91, 2384.

**OHIO RIVER near city of Evansville—Continued.****Surveys.**

Ordered by act of August 5, 1886, to determine a means for preventing a change of the river channel in front of the city. Made, 1887, under direction of Lieut. Col. Merrill, '88, 1716; '91, 2383.

**OLCOTT HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 380.)

**Appropriations.**

1887-'87 .....	\$128,000
1888.....	5,000, '88, 2061.
1890.....	30,000, '90, 2846.

Total ..... 163,000

**Contracts.**

1889. McCollum & Lee, for rock removal, at \$1.75, and dredging, at 25 cents per cubic yard, '89, 2401.

1891. Ira Farnsworth, for superstructure reconstruction, at a total of \$9,266, '91, 2895. Hingston & Woods, for rock removal, at \$1.24 per cubic yard, and dredging, at 24 cents per cubic yard, '91, 2895.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 280; '89, 332; '90, 301; '91, 377; '92, 356.

**ENGINEERS IN CHARGE.**

Capt. F. A. Mahan, 1886-'90. Reports, '88, 2059; '89, 2400.

Maj. A. Stickney, 1890-'92. Reports, '90, 2844; '91, 2893.

Maj. E. H. Ruffner, 1892-'—. Report, '92, 2536.

**Operations.**

1887-'88. 368 linear feet of west pier and 371 linear feet of east pier rebuilt by hired labor, '88, 2060.

1888-'89. No operations, '89, 2401.

1889-'90. 20,398 cubic yards mud and 721 cubic yards of rock removed, '90, 2845.

**Physical Characteristics.**

Description of the locality, '88, 2061.

**Projects.**

The original project was adopted in 1866 and proposed to connect deep water in Lake Ontario with deep water in Eighteen Mile Creek by the extension of two parallel piers from the mouth of the creek to the 11-foot curve in the lake, with the formation of a dredged channel between the piers; estimated cost, \$117,927, '66, iii, 15, iv, 158, 159; '74, i, 239; '76, ii, 578; '81, 2434.

The project was modified in 1872 to provide for the removal of rock in the channel between the piers, '72, 46, 248; '74, i, 239; also in 1881 to provide for additional pier extension, at an estimated cost of \$30,000 in excess of the original estimate, '81, 2434.

In 1890, after an aggregate expenditure of \$163,000, it was estimated that \$33,065 would be required for pier repair and widening of the channel, '90, 2846.

Project completed in 1892, '92, 2537.

**OLYMPIA HARBOR, WASH.—SURVEY FROM BUDDS INLET TO OLYMPIA.**

(Continued from Vol. II, p. 381.)

**Appropriations.**

1892..... \$35,000.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 411; '92, 384.

**ENGINEER IN CHARGE.**

Capt. T. W. Symons, 1891. Report, '92, 2733, 2736.

**ASSISTANTS.**

A. J. McMillan. Report, '92, 2735.

B. W. DeCourcy. Report, '92, 2740.

**OLYMPIA HARBOR, WASH.—Continued.****Physical Characteristics.**

Description of the locality, '92, 2735.

**Plans.**

By Capt. Symons, 1891, for excavation of a channel from Budds Inlet to the Fourth Street Bridge 12 feet deep at low water and 250 feet wide between pile and brush bulkheads, built 400 feet apart; also for the formation of a basin near the bridge 12 feet deep, 1,600 feet long, and 500 feet wide; estimated cost, \$275,000, '92, 2738.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '92, 2736.

**ONANCOCK HARBOR, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 381.)

**Appropriations.**

1879-'87 .....	\$8,000,	
1890 .....	6,000,	'91, 1198.
1892 .....	6,511,	'92, 978.

Total .....	20,511
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**Contracts.**

F. C. Somers, for dredging, at 18.9 cents per cubic yard, '91, 1198.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 112; '90, 102; '91, 129; '92, 129.

**ENGINEERS IN CHARGE.**

W. F. Smith, U. S. agent, 1888-'—. Reports, '90, 968; '91, 1197; '92, 977.

**ASSISTANT.**

A. Stierle. Report, '90, 968.

**Operations.**

1891-'92. 26,778 cubic yards material dredged through the outer and inner bars, '92, 977.

**Physical Characteristics.**

Description of the locality, '90, 969.

**Projects.**

By W. F. Smith, 1889, for improvement of the harbor entrance by excavation of a channel 300 feet wide and 8 feet deep through the outer bar, and one 200 feet wide and 8 feet deep through the river bar; estimated cost, \$12,511, '90, 971; '91, 1198.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of W. F. Smith, '90, 969.

**OMAHA, NEBR.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****ONTONAGON HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 382.)

**Appropriations.**

1887-'87 .....	\$285,600
1888 .....	12,500, '88, 1820.
1890 .....	10,000, '90, 2298.
1892 .....	20,000, '92, 2141.

Total .....	328,100
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List of appropriations, '90, 2298.

**ONTONAGON HARBOR, MICH.—Continued.****Contracts.**

1888. J. C. Morrison, for construction of 150 linear feet of substructure, at \$56 per running foot, and 200 linear feet of superstructure, at \$11.20 per running foot, '89, 2019.

1891. A. and D. Sang, for superstructure construction, at \$21.70 per running foot; Williams, Dougherty & Upham, for dredging, at 24½ cents per cubic yard, '91, 2504.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 233; '89, 271; '90, 244; '91, 314; '92, 299.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'89. Report, '88, 1819.

Maj. J. B. Quinn, 1889-'91. Reports, '89, 2018; '90, 2297.

Capt. W. L. Fisk, 1891-'—. Reports, '91, 2502; '92, 2139.

**Operations.**

1887-'88. 100 linear feet of superstructure completed on west pier, and pier extended 150 feet; east pier extended 50 feet, and minor repairs made to both east and west piers, '88, 1819.

1888-'89. West pier extended 150 feet; superstructure completed upon east pier, '89, 2018.

1889-'90. 50 linear feet of superstructure added to the east pier and 150 linear feet to the west pier, '90, 2288.

1890-'91. 24,488 cubic yards of material dredged from the channel, '91, 2503.

1891-'92. West pier superstructure completed, '92, 2140.

**Plans.**

By Maj. Quinn, 1889, for dredging the bar across the channel entrance, at an annual cost of \$15,000, '89, 2018.

**Projects.**

By Maj. Wheeler, 1867, for construction of 2 parallel piers of crib work 250 feet apart, extending 2,160 feet from the mouth of the Ontonagon River to the 18-foot curve in Lake Superior; dredging the channel between the piers to a depth of 12 feet; estimated cost, \$363,770, '67, 20, 63, 65; '86, 1641. Aggregate of appropriations from 1867 to 1886, inclusive, \$285,600, '86, 1642; '87, 1967.

**Surveys.****MAPS.**

'88, 1820.

**OOSTENLAULA AND COOSAWATTEE RIVERS, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 382.)

**Appropriations.**

1874-'82 ..... \$26,000

**Engineers.****ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1175.

Capt. P. M. Price, 1889-'—. Report, '89, 2797.

**Obstructions.**

Bridges obstructing navigation, '89, 2797.

**Operations.**

1887-'88. No operations since 1881, '88, 1175.

**Plans.**

Capt. Hoxie, 1888, states that the existing channels suffice for present commercial necessities and recommends no further appropriations, '88, 1175.

**Projects.**

By Capt. Overman, 1874, to secure a 3-foot depth of channel in the Oostenaula, and on the Coosawattee good navigation for boats drawing 2 feet during nine months of the year, the improvement to be accomplished by the removal of snags and trees, gravel and rock bars; estimated cost for Oostenaula, \$12,000, and for the Coosawattee, \$16,208.50, '74, i, 583; '75, i, 794; '80, 1693.

**OSAGE RIVER, MO. AND KANS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 383.)

**Appropriations.**

1871-'87 .....	\$200,000
1888 .....	5,000, '88, 1451.
1890 .....	55,000, '90, 1993.
1892 .....	50,000, '92, 1743.

Total ..... 310,000

List of appropriations, '88, 1451.

**Commerce.**

Resources of the locality, '90, 1997, 2002.

List of steamers engaged on the river during 1891, '92, 1745.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 195; '89, 229, 230; '90, 205, 206; '91, 262; '92, 251.

**ENGINEER IN CHARGE.**

Maj. A. M. Miller, 1885-'—. Reports, '88, 1450; '89, 1705; '90, 1992, 1996; '91, 2114; '92, 1742.

**ASSISTANTS.**

J. W. Beaman. Reports, '89, 1706; '90, 1993; '91, 2115; '92, 1743.

C. D. Lamb. Report, '90, 1999.

**Operations.**

1887-'88. No operations, '88, 1450.

1888-'89. 1,126 linear feet of cross dam and training wall repaired; 110 linear feet of new dam built; 29 snags and 53 rocks removed from the channel; work done by hired labor, '89, 1705, 1706.

1889-'90. 12 snags and 3 rock heaps removed from the channel, '90, 1992.

1890-'91. No operations, '91, 2114.

1891-'92. 66 snags removed from the channel and 342 trees cleared from the banks, '92, 1743.

**Physical Characteristics.**

Description of the river, '90, 1996.

Gauge record, at Tuscomb, Mo., for 1891, '91, 2117; 1892, '92, 1744.

**Projects.**

The original project adopted in 1871 proposed contracting the width of the river at shoals by means of cross dams and training walls, dredging by means of teams and scrapers, and removal of rocks and snags from channel, and trees from banks, the object being to obtain a 2-foot low-water navigation; estimated cost, \$230,000, '71, 238; '86, 1395.

In 1890 Maj. Miller proposed the construction of a lock and dam near the mouth of the Osage, with a lift of 10.5 feet and a width of 52 feet, at an estimated cost of \$200,000, '90, 1995; '92, 1742; making the total cost of improvement of the river, \$430,000, '92, 1742.

**Surveys.**

Survey ordered by act of August 11, 1888. Made, 1890, under direction of Maj. Miller, '90, 1995.

**OSWEGO, N. Y.—CONSTRUCTION OF BREAKWATER AT.**

(Continued from Vol. II, p. 384.)

**Appropriations.**

1826-'79 .....	\$1,630,012.87
1888 .....	100,000.00, '88, 2085.
1890 .....	30,000.00, '90, 2867.
1892 .....	40,000.00, '92, 2593.

Total ..... 1,800,012.87

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 284; '89, 335; '90, 304; '91, 382; '92, 360.

**ENGINEERS IN CHARGE.**

Capt. C. F. Palfrey, 1886-'90. Reports, '88, 2082; '89, 2417.

Maj. M. B. Adams, 1890. Report, '90, 2862.

Capt. D. C. Kingman, 1891-'—. Reports, '91, 2912; '92, 2581.

**ASSISTANT.**

Wm. P. Judson. Report, '92, 2594.

**OSWEGO, N. Y.—Continued.****Operations.**

- 1887-'88. 846 linear feet of shore-arm superstructure renewed; breaches in breakwater closed, and minor repairs to piers and breakwater, '88, 2084.  
 1888-'89. Minor repairs to outer west breakwater; repair and extension of light-house pier, '89, 2419.  
 1889-'90. Spur crib built and placed on lake front of outer breakwater; 277 cubic yards riprap placed; repairs to breaches, decking, and lake arm of outer breakwater; work done by hired labor, '90, 2864, 2866.  
 1890-'91. 1,300 linear feet of outer breakwater superstructure rebuilt; repairs to wharf and outer breakwater, '91, 2914.  
 1891-'92. 170 linear feet of outer breakwater superstructure rebuilt; 26,845 cubic yards of material dredged; repairs to outer breakwater, '92, 2581.

**Projects.**

The earliest project was adopted in 1827 and proposed to inclose an area at the mouth of the river by extending piers from the shores into the lake, and joining the outer ends of the piers with the shores by lateral breakwater, '74, 1, 261, 262. This project was completed in 1869 and the work forms the present inner harbor.

From 1826 to 1869, inclusive, \$473,362.87 was appropriated. In 1870 the present project was adopted, and it consists of a breakwater 5,800 feet in length, parallel to the old west breakwater and about 1,100 feet in advance of it; the estimated cost was \$1,161,682, '70, 221; '86, 345. The project was modified in 1879, 1880, 1882, and 1883 by the proposed construction of an east breakwater 2,700 feet long, the reduction of 350 feet in the opening between the east end of the west breakwater and the north end of light-house pier; the use of creosoted timber in repairs to the old breakwater, the construction of spurs along the outer face of the west breakwater, and the deepening, by dredging, of the inner harbor at the mouth of the river, '79, 1743; '86, 345. The amount appropriated from 1870 to 1886, inclusive, was \$1,162,250.

The Board of Engineers of 1887 recommended the removal of the part of the east breakwater already built, '87, 2391.

History of past projects, '87, 2381.

In 1889 Capt. Palfrey estimated \$192,000 as required for completion of the project, including the construction of parapet superstructure and general repairs to existing works, '89, 2421.

**OTTER CREEK, VT.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 386.)

**Appropriations.**

1872-'82 .....	\$34, 000
1888 .....	2, 500, '88, 2100.
1890 .....	5, 000, '90, 2881.
1892 .....	10, 000, '92, 2612.

Total ..... 51, 500

**Contracts.**

1889. L. Whitney, for dredging, '89, 2450.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 289; '89, 842; '90, 308; '91, 386; '92, 365.

ENGINEER IN CHARGE.

Maj. M. B. Adams, 1885-'— Reports, '88, 2100; '89, 2450; '90, 2881; '91, 2935.

**Operations.**

- 1887-'89. No operations, '88, 2100; '89, 2450.  
 1889-'90. 21,000 cubic yards material dredged, '90, 2881.  
 1890-'91. No operations, '91, 2935.  
 1891-'92. 20,995 cubic yards material dredged, '92, 2612.

**Projects.**

The project proposed by Col. Newton in 1872 proposed the formation of a channel from Lake Champlain to Vergennes Basin 100 feet wide and 8 feet deep, with the formation of a basin at Vergennes; estimated cost, \$58,148, '72, 273; '81, 725.

In 1882 the project was modified to provide for rock removal at steamboat landing, near Vergennes, increasing the estimated cost to \$73,748.40, '82, 712.

In 1884 it was further modified so as to provide for a change in the hitherto proposed channel at Bull Brook Bend so as to escape the removal of rock, '84, 2159.

**ORVENDEN AND WANDO RIVERS, S. C.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 158; '90, 141.

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888. Report, '90, 1239.

**Physical Characteristics.**

Description of the locality, '90, 1239.

**Plans.**

By Capt. Abbot, 1889, for an inland waterway connecting Bulls Bay and the harbor of Charleston (1) by the Orvenden and Wando rivers; estimated cost, \$1,500,000; (2) by the Sea Island route; estimated cost, \$750,000, '90, 1243, 1244.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Abbot, '90, 1243.

**OUACHITA AND BLACK RIVERS, ARK. AND LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 386.)

**Appropriations.**

1871-'87 .....	\$307,500
1888 { Ouachita and Black rivers, La. and Ark..	20,000, '88, 1348.
{ Ouachita River, Ark., above Camden.....	9,000, '88, 178.
1890. Ouachita .....	15,000, '90, 1878.
1892. Ouachita .....	40,000, '92, 1605.

Total..... 391,500

List of appropriations, '88, 1348.

**Commerce.**

Commerce of the river and list of steamers engaged, '91, 1973; '92, 1606.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 178; '89, 209, 217; '90, 188; '91, 238, 239; '92, 231.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1887-'— Reports, '88, 1346; '89, 1596, 1631; '90, 1871, 1878; '91, 1964, 1975; '92, 1602.

**Operations.**

1887-'89. No operations, '88, 1347; '89, 1596.

1889-'90. 2,970 snags, stumps, and logs removed from the channel, and 8,580 trees cut and girdled on the banks between Camden and the mouth, '90, 1872. 3,130 snags and 11 cubic yards rock removed from the channel; 66 cubic yards stone and 100 linear feet brush wing dams built; 39,800 trees girdled and cut, and 138,563 square yards brush and willows cut from banks above Camden, '90, 1878.

1890-'91. 1,470 snags cleared from the channel; 34,548 trees and stumps removed from the banks; 10,035 trees girdled; 6,767 square yards willows and brush cut, and 250 linear feet of brush dams built between Camden and the mouth, '91, 1965, 1966. 1,467 snags and 29 cubic yards rock removed from the channel; 783 trees and 4,304 square yards of brush cleared from the banks, and 800 linear feet of brush dams built above Camden, '91, 1976.

1891-'92. 2,562 snags cleared from the channel, and 11,368 shore snags removed from the banks; 77,342 trees cut; 24,543 trees girdled, and 675 square yards of brush and willows cut, '92, 1604.

**Physical Characteristics.**

Description of the Ouachita; table of distances, falls, etc., '89, 1633.

**Plans.**

In 1889, after examination of the Ouachita River from its mouth to head of navigation, Capt. Willard considered that the amount of commerce to be benefited did not justify a permanent improvement, '89, 1631, 1637.

**Projects.**

The first appropriations were made with a view to the improvement of the river by means of a system of locks and dams, the estimated cost of which was \$1,163,083, '72, 346, 348, 370, 374; '73, 484.

A portion of the funds appropriated was expended under this project for material, surveys, etc., when it was abandoned in 1875, '75, i, 521; '80, 1306. The balance of the funds was expended in the purchase and operation of an iron-hulled snag boat. The present project contemplates the removal of wrecks,

**OUACHITA AND BLACK RIVERS, ARK. AND LA.—Continued.****Projects—Continued.**

logs, snags, leaning timber, etc., and improvement of shoal places from Camden, Ark., to mouth of Black River, a distance of 369 miles. The character of the project does not admit of a permanent improvement or a definite estimate, '80, 1306; '84, 1386; '86, 231; '88, 1347. By act of 1884 the Black River, Ark. and La., was placed under the same head as the Ouachita, '86, 1351. Amount expended on present project to June 30, 1888, including cost of snag boat and outfit, \$193,912, '88, 1348.

By Capt. Willard, 1887, for improvement of the Ouachita from Camden up to Arkadelphia, a distance of 76 miles, by cutting leaning timber, removing snags, and building brush dams at the shoals; estimated cost, \$9,000, '89, 1598.

**Surveys.**

Examination for permanent improvement of Ouachita River from its mouth to head of navigation ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Willard, '89, 1631.

**MASS.**

'91, 1966, 1969.

**OWENSBOROUGH HARBOR, KY.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 254; '91, 294, 2380.

**ENGINEER IN CHARGE.**

Lieut. Col. W. E. Merrill, 1888. Reports, '89, 1903; '91, 2380.

**Plans.**

In 1889 Lieut. Col. Merrill did not consider the locality in need of improvement, '89, 1904; '91, 2380.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Merrill, '89, 1903.

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Merrill, '91, 2380.

**PAMLICO AND BAY RIVERS, N. C.—EXAMINATION OF WATERWAY BETWEEN.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 170, 1421.

**ENGINEER IN CHARGE.**

Capt. W. H. Bixby, 1890. Report, '91, 1422.

**ASSISTANT.**

Lieut. M. M. Patrick. Report, '91, 1423.

**Physical Characteristics.**

Description of the locality, '91, 1422.

**Plans.**

In 1890 Capt. Bixby did not consider the locality worthy of improvement, '91, 1423.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Bixby, '91, 1422.

**PAMLICO AND TAR RIVERS,\* N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 390.)

**Appropriations.**

1836-'87 .....	\$68, 000
1888 .....	10, 000, '88, 856.
1890 .....	10, 000, '90, 1114.
1892 .....	10, 000, '92, 1120.

Total .....	98, 000
List of appropriations, '92, 1122.	

\* The Pamlico and Tar rivers are different portions of a single stream, the upper portion being called the Tar.



**PAMLICO AND TAR RIVERS, N. C.—Continued.****Commerce.**

Development of, under improvement, '88, 857; '89, 1045.

Lowering of freight rates consequent upon improvement, '91, 1348.

List of steamers and statement of freight transported for 1892, '92, 1122.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 117; '89, 136; '90, 122; '91, 157; '92, 158.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1886-'92. Reports, '88, 854; '89, 1044, 2796; '90, 1112; '91, 1347.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1118.

**ASSISTANTS.**

J. D. Whitford. Report, '88, 856.

R. Ransom. Reports, '89, 1046; '90, 1114; '91, 1349.

W. H. Chadbourne, jr. Report, '92, 1121.

**Obstructions.**

Bridges obstructing the Upper Pamlico River, '89, 2796.

**Operations.**

1887-'88. 355 logs, snags, and stumps, 122 jetty piles, and 55 cords of brush and small snags removed, clearing a channel 60 feet wide by 2.5 feet deep and 5 miles in length, '88, 855.

1888-'89. 2,480 trees, logs, and stumps and 16 cords of snags removed from the river, and 1,270 trees and logs removed from the banks, '89, 1045.

1889-'90. No operations, '90, 1113.

1890-'91. Repairs to plant, '91, 1349.

1891-'92. 4,548 snags and logs and 40 cords of small snags cleared from the channel, and 3,666 trees and 623 cords brush cut on the banks, '92, 1121.

**Physical Characteristics.**

Original condition of the rivers, '88, 854.

**Projects.**

These two rivers have been considered by Congress separately prior to 1880, but jointly ever since then. The original project of 1876 (for the Pamlico) and of 1879 and 1889 (for the Tar), as since slightly modified and continued to date, proposed to secure a clear and safe channel 9 feet deep at low water up to Washington; thence a channel 60 feet wide and 3 feet deep at low water for 23 miles farther to Greenville; and thence a channel 60 feet wide and 20 inches deep at low water for 26 miles farther to Tarboro and Rocky Mount Little Falls. The total final cost of this work was estimated in 1889 to be \$92,200, '90, 1112.

**Surveys.****MAPS.**

'90, 1114; '91, 1348; '92, Atlas, 22.

**PAMUNKY RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 390.)

**Appropriations.**

1880-'87 .....	\$12,500
1888 .....	3,000, '88, 830.
1890 .....	3,000, '90, 1075.
1892 .....	3,000, '92, 1063.

Total ..... 21,500

List of appropriations, '88, 830.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 112; '89, 130; '90, 117; '91, 145; '92, 146.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1880-'91. Reports, '88, 828; '89, 1013; '90, 1074.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1275.

Maj. C. E. L. B. Davis, 1892-'—. Report, '92, 1062.

**PAMUNKY RIVER, VA.—Continued.****Operations.**

- 1887-'88. 673 linear feet of dike built; 310 logs, snags, stumps, and trees removed; 12 mats built and sunk, '88, 829.  
 1888-'89. No operations, '89, 1013.  
 1889-'90. 90 trees, logs, and snags removed; repairs made to dikes at Skidmore and Spring Bars; 566 linear feet pile and brush dike built at Skidmores Bar by hired labor; 8,076 cubic yards material dredged under contract, '90, 1074.  
 1890-'91. No operations, '91, 1276.  
 1891-'92. 140 snags removed from the channel, and 103 trees cleared from the banks, '92, 1063.

**Physical Characteristics.**

Description of the river, '88, 828.

**Projects.**

By Capt. Phillips, 1880, for improvement of river by dredging through sand and gravel bars, and removal of snags, logs, and similar obstructions, forming a channel 40 feet wide and from 5 to 6 feet deep at low water; estimated cost, \$19,541, '80, 905, 906. Increased in 1885 to provide for additional work on lower bars to \$28,300, '85, 983; '87, 943; '91, 1275.

**Surveys.****MAPS.**

'88, 828; '90, 1074.

**PASCAGOULA RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 391.)

**Appropriations.**

1827-'87 .....	\$104,500
1888 .....	27,000, '88, 1212.
1890 .....	20,000, '90, 1708.
1892 .....	20,000, '92, 1455.

Total ..... 171,500

List of appropriations, '88, 1210.

**Contracts.**

1890. G. C. Forbes & Co., for dredging, at 16.2 cents per cubic yard, '90, 1707. Alabama Dredging and Jetty Company, for dam construction, at \$3,350, '90, 1707.  
 1891. Alabama Dredging and Jetty Company, for dredging, at 24 cents per cubic yard, '91, 1791.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 163; '89, 190; '90, 172; '91, 217; '92, 210.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1878-'—. Reports, '88, 1210; '89, 1443; '90, 1706; '91, 1788; '92, 1453.

**Operations.**

- 1887-'88. Dredging under contract continued, '88, 1211.  
 1888-'89. No operations, '89, 1445.  
 1889-'90. 52,685 cubic yards material dredged, '90, 1707.  
 1890-'91. 131,656 cubic yards material dredged, '91, 1710.  
 1891-'92. 160,217 cubic yards material dredged; 205 snags and logs cleared from the channel, and 269 trees cleared from the banks, '92, 1455.

**Projects.**

The project of 1879 proposed the formation of a dredged channel through the bar at the mouth 200 feet wide and 7 feet deep, and the removal of snags and overhanging trees from the river for its entire length; estimated cost, \$53,800, '74, 1,757; '79, 831.

From 1878 to 1885, inclusive, \$59,000 was appropriated, '86, 1204.

In 1886 it was proposed to form, by dredging, a channel 12 feet deep from the mills at Moss Point to the anchorage in the bay, a distance of 11½ miles; estimated cost, \$78,100, '86, 1217.

Owing to increased cost of excavation the estimate was raised to \$110,000, with \$69,000 for completion in 1890, '90, 1708.

**PASQUOTANK RIVER, N. C.—IMPROVEMENT OF.****Appropriations.**

1890..... \$3,000, '91, 1337.  
 1892..... 3,000, '92, 1113.

Total ..... 6,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 148; '91, 155; '92, 156.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1888-'92. Reports, '89, 1135; '91, 1335.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1111.

**ASSISTANT.**

C. Schuster. Report, '91, 1337.

**Operations.**

1890-'91. 1,614 snags and one wreck removed from the channel, and 65 overhanging trees cleared from the banks, '91, 1336.

1891-'92. No operations, '92, 1112.

**Physical Characteristics.**

Description of the locality, '89, 1136.

**Projects.**

By Capt. Bixby, 1889, for improvement for steamboats between the ends of Turners Cut, and the barges from the Moccasin Tract up about 5 miles to the Lebanon Bridge; estimated cost, \$9,000, '89, 1137; '91, 1335.

In 1892 Maj. Stanton recommended that further improvement above the mouth of Moccasin Tract be discontinued, '92, 1112.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1135.

**MAPS.**

'91, 1337; '92, Atlas, 19.

**PASSAIC RIVER below Newark, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 393.)

**Appropriations.**

1872-'87 ..... \$172,500  
 1888..... 27,000, '88, 648.  
 1890..... 40,000, '90, 851.  
 1892..... \*45,000, '92, 875.

Total ..... 284,500

List of appropriations, '92, 875.

**Commerce.**

Commercial interests of the river, '88, 647, 648.

**Contracts.**

1889. R. G. Packard, for dredging, at 22 cents per cubic yard, '90, 850.

1891. R. G. Packard, for dredging, at 30 cents per cubic yard, '91, 990.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 69; '89, 88; '90, 79; '91, 102; '92, 102.

**ENGINEERS IN CHARGE.**

Capt. G. McC. Derby, 1886-'89. Report, '88, 646.

Capt. T. L. Casey, 1889-'—. Reports, '89, 825; '90, 849; '91, 988; '92, 873.

**Operations.**

1887-'88. 500 linear feet of dike built, '88, 647.

1888-'89. Dike extension under contract continued, '89, 826.

1889-'90. 60,008 cubic yards material dredged, '90, 850.

1890-'91. No operations, '91, 989.

1891-'92. 100,692 cubic yards material dredged, '92, 873.

**Projects.**

By Col. Newton, 1880, for formation of a channel 200 feet wide and 10 feet deep at mean low water from the Pennsylvania Railroad Bridge at Newark to Newark Bay by dredging and the construction of 15,800 linear feet of pile dike; estimated cost, \$232,875, '80, 537; '84, 741.

\* For improvement of the entire river, '92, 875.

**PASSAIC RIVER below Newark, N. J.—Continued.****Projects—Continued.**

By Lieut. Col. Gillespie, 1884, for extension of channel through shoals in Newark Bay by dredging and the extension of the dike at the mouth of the river about 8,000 feet; estimated cost, \$121,000, increasing the original estimate to \$353,875, '84, 741; '87, 765, 766.

**PASSAIC RIVER above Newark, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 392.)

**Appropriations.**

1872-'87 .....	\$126,250
1888 .....	7,500, '88, 646.
1890 .....	5,100, '90, 849.

Total ..... 138,850

List of appropriations, '88, 646.

**Commerce.**

Commercial interests of the river, '88, 646.

**Contracts.**

1891. R. Parrott, for dredging, at 35 cents per cubic yard, '91, 992.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 68; '89, 87; '90, 78; '91, 100; '92, 102.

**ENGINEERS IN CHARGE.**

Capt. G. McC. Derby, 1887-'89. Report, '88, 645.

Capt. T. L. Casey, 1889-'— . Reports, '89, 824; '90, 848; '91, 990; '92, 876.

**Operations.**

1887-'90. No operations on account of insufficient allotments, '88, 646; '89, 824; '90, 848.

1890-'91. No operations, '91, 991.

1891-'92. 10,718 cubic yards material dredged under contract and 2,333 cubic yards by hired labor, '92, 877.

**Projects.**

By Lieut. Col. Newton, 1872, for partial improvement of river above Newark, so as to afford a channel 6 feet deep at low water to the head of navigation at Passaic, by means of dredging and dike construction; estimated cost, \$123,924, '72, 805, 807; '80, 536; '86, 793.

In 1885 the project was amended to provide for a channel 7½ feet deep from the Erie to the Midland Railroad Bridge, '87, 764.

From 1872 to 1886, inclusive, \$126,250 was appropriated, when it was estimated that \$7,512 would be required for completion of project, '86, 796, 797. Amount required for completion increased in 1890 to \$8,199.79, to include plant purchased, '90, 849.

By Capt. Casey, 1890, for excavating a channel 100 feet wide and 6 feet deep for a distance of 1,600 feet through Third River Bar; also for removal of bowlders at various points in the river, increasing the total estimated cost of the improvement to \$193,822, '91, 991, 992.

**Surveys.**

Of river above Newark. Made, 1889, under direction of Capt. Casey, '90, 848.

**PASSO CAVALLO, TEX.—(See MATAGORDA BAY.)****PATAPSCO RIVER, MD.—(See BALTIMORE HARBOR.)****PATCHOGUE RIVER, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 394.)

**Appropriations.**

1890 .....	\$15,000, '91, 827.
1892 .....	8,000, '92, 726.

Total ..... 23,000

8648—22

**PATCHOGUE RIVER, N. J.—Continued.****Contracts.**

1891. E. Bailey & Sons, for jetty construction, riprap, at \$2.80 per ton, '91, 828.  
 1892. A. E. Smith, for dredging, at 20 cents per cubic yard, '92, 726.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 78; '92, 83.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1890-'— Reports, '91, 825; '92, 724.

**Operations.**

1890-'91. 450 tons of stone placed in riprap jetty, completing 150 linear feet of the same, '91, 827.

1891-'92. 2,552 tons of riprap delivered in the jetty, completing 900 linear feet of the same; 16,265 cubic yards material dredged from the channel, '92, 725.

**Physical Characteristics.**

Description of the locality, '91, 825.

**Projects.**

By Lieut. Col. McFarland, 1886, for excavation of a channel 60 feet wide from the highway bridge at Patchogue to the 6-foot contour in Great South Bay, a distance of 1 mile; also for protection of the channel in the bay by a riprap jetty along the west side 1,700 feet in length; estimated cost, \$40,000, '91, 826.

**PATUXENT RIVER, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 395.)

**Appropriations.**

1888.....	\$5,000, '89, 998.
1890.....	6,000, '90, 1060.
Total .....	11,000

**Commerce.**

Trade of the river, '88, 847.

**Contracts.**

1889. T. P. Morgan, for dredging, at 20 cents per cubic yard, '90, 1060.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 110, 116; '89, 124; '90, 111; '91, 141; '92, 142.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1886-'91. Reports, '88, 846, 848; '89, 998; '90, 1060.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1262.

Maj. C. E. L. B. Davis, 1892-'— Report, '92, 1049.

**Operations.**

1887-'89. No operations, '88, 846; '89, 998.

1889-'90. 18,295 cubic yards material dredged, '90, 1060.

1890-'91. 19,525 cubic yards material dredged, '91, 1263.

1891-'92. No operations, '92, 1050.

**Physical Characteristics.**

Description of the river, '88, 846.

**Projects.**

By S. T. Abert, 1888, for improvement of the Patuxent River between Benedict and Hills Landing by dredging through Bristol and Swanns Point bars a channel 200 feet wide and from 12 to 13 feet deep; estimated cost, \$80,000, '88, 850; '91, 1263.

In 1891 Lieut. Col. Hains considered the improvements already made upon the river sufficient for its present trade, and recommended no further appropriations, '91, 1263.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of S. T. Abert, '88, 848.

**MAPS.**

'88, 850; '90, 1060.

**PAWCATUCK RIVER, R. I. AND CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 395.)

**Appropriations.**

1871-'87 .....	\$62,000
1888.....	10,000, '88, 510.
1890.....	16,600, '90, 580.
1892.....	3,800, '92, 634.

Total ..... 92,400

**Contracts.**

1890. Hartford Dredging Company, for dredging, at 21 cents per cubic yard, '91, 728.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 43; '89, 53; '90, 48; '91, 60; '92, 64.

**ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1887-'92. Reports, '88, 509; '89, 635; '90, 578; '91, 726.

Capt. W. H. Bixby, 1892-'— . Report, '92, 633.

**Operations.**

1887-'88. 48,939 cubic yards sand, mud, and bowlders excavated from the channel, '88, 509.

1888-'89. 8,355 cubic yards material and 6 cubic yards bowlders removed from the channel, '89, 635.

1889-'90. 339 tons of rock and 7,509 cubic yards of sand and gravel removed from the channel, '90, 579.

1890-'91. 17,316 cubic yards material dredged, '91, 727.

1891-'92. 25,416 cubic yards material dredged, '92, 634.

**Projects.**

From 1871 to 1875, inclusive, \$50,000 was appropriated and expended upon the excavation of a channel  $5\frac{1}{2}$  feet deep at low water and 75 feet wide below the wharves, and from 35 to 40 feet wide between the upper and lower wharves, '71, 741, 744; '75, ii, 296; '87, 565.

The present approved project contemplates widening the channel to 100 feet below the wharves and to 140 feet between the upper and lower wharves, the entire channel to be dredged to 8 feet at mean low water; estimated cost, \$38,637, '88, 43; '91, 727.

**PAWTUCKET RIVER, R. I.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 395.)

**Appropriations.**

1867-'87 .....	\$132,000
1888.....	35,000, '88, 497.
1890.....	30,000, '90, 568.
1892.....	35,000, '92, 618.

Total ..... 232,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 38; '89, 49; '90, 43; '91, 54; '92, 58.

**ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1887-'92. Reports, '88, 496; '89, 621; '90, 566; '91, 709.

Capt. W. H. Bixby, 1892-'— . Report, '92, 616.

**Operations.**

1887-'88. 72,248 cubic yards material dredged, '88, 496.

1888-'89. No operations, '89, 622.

1889-'90. 54,923 cubic yards sand and 128 cubic yards bowlders and ledge rocks removed from channel by hired labor, '90, 567.

1890-'91. No operations, '91, 710.

1891-'92. 70,213 cubic yards material dredged by hired labor, '92, 617.

**Physical Characteristics.**

Description of the locality, '90, 566.

**Projects.**

The projects of 1868 to 1874 proposed the formation, by dredging, of a channel 7 feet deep at low water and 75 feet wide from the mouth to the city of Pawtucket, '67, 449; '68, 746; '70, 450; '75, ii, 290. This work was completed in 1875, '76, i, 49, 207; '80, 81; '83, 82; '84, 609.

**PAWTUCKET RIVER, R. I.—Continued.****Projects—Continued.**

By Lieut. Col. Elliot, 1884, for the formation of a channel, by rock removal and dredging, 100 feet wide and 12 feet deep at mean low water from the Red Bridge to the rock cutting at Pawtucket; thence a channel to Pawtucket Bridge 40 feet wide and 12 feet deep; estimated cost, \$382,478, '84, 85, 613; '85, 593; '87, 548.

**PEARL RIVER, MISS., below Jackson.—IMPROVEMENT OF,**

(Continued from Vol. II, p. 398.)

**Appropriations.**

1880-'87 .....	\$93, 125
1880.....	15, 000, '88, 1225.
1890.....	20, 000, '90, 1716.
1892.....	15, 000, '92, 1462.

Total ..... 143, 125

List of appropriations, '88, 1222.

**Commerce.**

Reduction in freight rates consequent upon improvement, '88, 1224.

Benefits from improvement, '90, 1716.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 165; '89, 192; '90, 174; '91, 219; '92, 212.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1884'— Reports, '88, 1221; '89, 1455; '90, 1714; '91, 1795; '92, 1460.

**Operations.**

1887-'88. 210 snags and logs removed from channel, 256 piles driven, and 406 cords of willow mattress placed, '88, 1223.

1888-'89. 1,960 snags, logs, and trees removed from the channel, and 2,120 trees and logs sunk in Old River Bulkhead; 700 cords of willow mattress placed, '89, 1458.

1889-'90. 2,988 snags, stumps, and trees removed from the channel, and 2,520 trees removed from the banks, '90, 1715.

1890-'91. Log flat built, '91, 1796.

1891-'92. 1,002 snags and 9 drift piles removed from the channel, and 13,077 trees cleared from the banks, '92, 1463.

**Projects.**

By Maj. Howell, 1879, for improvement of the river from Jackson to the mouth, by removal of all trees, snags, logs, and similar obstructions, to a depth of 5 feet below low-water mark; also by removal of overhanging trees from the banks; estimated cost, \$95,940, '80, 1155; '87, 1339.

Project modified in 1885 to provide for dredging a channel 12 feet deep at mean low water over the bar at the mouth of East Pearl River, '85, 1367; '87, 1341.

Amount appropriated from 1880 to 1886, inclusive, \$93,125; amount estimated to complete project, \$70,000, '87, 1339, 1342.

In 1892 it was estimated that an annual expenditure of \$5,000 would be required to maintain the improvement, '92, 1462.

**PEARL RIVER, MISS., between Carthage and Jackson.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 397.)

**Appropriations.**

1879-'87 .....	\$20, 750
1888.....	2, 500, '88, 1220.
1890.....	3, 000, '90, 1714.
1892.....	5, 000, '92, 1464.

Total ..... 31, 250

List of appropriations, '88, 1219.

**PEARL RIVER, MISS., between Carthage and Jackson—**  
Continued.

**Commerce.**

Reduction in freight and insurance rates consequent upon improvement, '88, 1220.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 165; '89, 192; '90, 173; '91, 220; '92, 213.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1885—'. Reports, '88, 1218; '89, 1452; '90, 1713; '91, 1797; '92, 1462.

**Operations.**

1887-'88. 27,000 snags, stumps, and sunken logs removed from the channel, and 746 overhanging trees removed from the banks, '88, 1226.

1888-'89. 27,532 snags, stumps, and sunken logs removed from the channel, and 372 overhanging trees removed from the banks, '89, 1454.

1889-'90. No operations, '90, 1713.

1890-'91. 9,148 snags cleared from the channel, and 1,194 trees cleared from the banks, '91, 1798.

1891-'92. 10,330 snags removed from the channel, and 5,712 trees cleared from the banks, '92, 1463.

**Projects.**

By Maj. Howell, 1879, for improvement of the river between Carthage and Jackson, a distance of 105 miles, providing for a clear channel 5 feet deep at low stage of the river, by removal of snags, logs, etc.; estimated cost, \$21,000, '79, 878, 900; '87, 1336. Estimate revised in 1887 to \$50,000, '87, 1336; '91, 1797.

**PEARL RIVER, MISS., between Edinburg and Carthage.—**  
IMPROVEMENT OF.

(Continued from Vol. II, p. 397.)

**Appropriations.**

1884-'87 .....	\$4, 750
1888.....	5, 000, '88, 1218.
1890.....	5, 000, '90, 1712.
1892.....	500, '92, 1466.

Total ..... 15, 250

List of appropriations, '89, 1450.

**Commerce.**

Reduction in freight and hauling rates due to improvement, '88, 1217; '89, 1451.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 164; '89, 191; '90, 173; '91, 220; '92, 214.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1885—'. Reports, '88, 1216; '89, 1450; '90, 1711; '91, 1799; '92, 1465.

**Operations.**

1887-'88. 4,011 snags, trees, and stumps removed from the channel, and 128 overhanging trees from the banks, '88, 1217.

1888-'89. 7,970 logs, snags, and stumps removed from the channel, and 826 overhanging trees from the banks, '89, 1451.

1889-'90. 3,812 logs, snags, and stumps removed from the channel, and 3,965 overhanging trees cut from the banks, '90, 1712.

1890-'91. No operations, '91, 1799.

1891-'92. 22,884 snags and stumps and 31 piles of drift removed from the channel, and 9,700 trees and logs cleared from the banks, '92, 1465.

**Projects.**

By Maj. Stickney, 1884, for improvement of the river between Carthage and Edinburg, a distance of 25 miles, giving a high-water channel for six months of the year, by removal of snags, logs, and similar obstructions; estimated cost, \$13,469, '84, 1289; '85, 1371; '87, 1334; '88, 1216. Project completed in 1890 at a cost of \$14,750, '90, 1712. An annual expenditure of \$500 required for maintenance of improvement, '92, 1466.



**PEASE CREEK, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, pp. 117 and 399.)

**Appropriations.**

1881-'90 ..... \$51,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 147; '89, 169; '90, 152; '91, 190.

**ENGINEER IN CHARGE.**

Capt. W. M. Black, 1886-'—. Reports, '88, 1102; '89, 1339; '90, 1600.

**ASSISTANT.**

Lient. D. D. Gaillard. Report, '88, 1104.

**Operations.**

1887-'90. No operations for lack of funds, '88, 1102; '89, 1340; '90, 1601.

**Physical Characteristics.**

Description of the river, '88, 1102; '89, 1339.

**Projects.**

By Capt. Black, 1888, for improvement of Pease River between the Florida Southern Railroad Wharf and deep water of the harbor by rock excavation, removal of snags, and clearing the banks of overhanging trees, giving a 2-foot navigable channel of 30 feet width during about half the year; estimated cost, \$25,000, '88, 1102, 1103.

**PECONIC RIVER, N. Y.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 81.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1890. Report, '91, 855.

**Physical Characteristics.**

Description of the locality, '91, 855.

**Plans.**

By Col. Houston, 1891, for excavation of a channel 75 feet wide and 6 feet deep at mean low water from the head of Merritt Bay to Peconic Bay; formation of a turning basin in Merritt Bay 250 feet long, 400 feet wide, and 6 feet deep, and extension of the channel to 2,000 feet above Merritt Bay; estimated cost, \$44,000, '91, 858.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Col. Houston, '91, 857.

**PEE DEE RIVER, GREAT, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 400.)

**Appropriations.**

1880-'87 .....	\$47,000
1888 .....	20,000, '88, 920.
1890 .....	12,500, '90, 1217.
1892 .....	10,000, '92, 1205.

Total ..... 89,500

List of appropriations, '89, 1180.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 129; '89, 153; '90, 138; '91, 172; '92, 171.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'89. Report, '88, 920.

Capt. F. V. Abbot, 1889-'—. Reports, '89, 1179; '90, 1215; '91, 1450; '92, 1203.

**ASSISTANT.**

R. Whitford. Reports, '88, 923; '89, 1180; '90, 1217; '91, 1452; '92, 1205.

**Operations.**

1887-'88. 634 logs, trees, and stumps removed; also 1,690 trees from the banks, '88, 922.

**PEE DEE RIVER, GREAT, S. C.—Continued.****Operations—Continued.**

1888-'89. 220 trees and stumps and 14 cords small snags removed from the channel; 50 trees and 6½ cords of brush removed from the banks, '89, 1181.  
 1889-'90. 1,517 logs, trees, and snags removed from the channel; 3,551 trees and 100 cords of brush cut from the banks, '90, 1217.  
 1890-'91. 1,080 snags removed from the channel, and 1,034 trees cleared from the banks, '91, 1452.  
 1891-'92. 1,648 snags and 10 cords of small snags removed from the channel, '92, 1205.

**Physical Characteristics.**

Original condition of the river, '88, 920.

**Projects.**

By Capt. Phillips, 1880, for improvement of Great Pee Dee River by removal of obstructions, natural and artificial, so as to secure a navigable depth of 9 feet as high as Smiths Mills, about 46 miles above the confluence of the Pee Dee and Waccamaw rivers, and from thence a depth of 3½ feet as high as the turn of Cheraw, a distance of 149 miles above the confluence of the two rivers above mentioned, '80, 124, 845; '91, 1450.

**Surveys.**

MAPS.

'89, 1180.

**PEE DEE RIVER, LITTLE, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 401.)

**Appropriations.**

1888.....	\$5,000, '88, 128.
1890.....	5,000, '90, 1213.
1892.....	5,000, '92, 1202.

Total ..... 15,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 128; '89, 153; '90, 138; '91, 171; '92, 171.

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888-'—. Reports, '89, 1175; '90, 1212; '91, 1448; '92, 1201.

ASSISTANT.

R. Whitford. Reports, '89, 1176; '91, 1449; '92, 1203.

**Operations.**

1887-'88. No operations, '88, 128.

1888-'89. 883 trees, logs, and snags removed from channel, and 1,771 trees cut and trimmed on the banks, '89, 1176.

1889-'90. 1,481 stumps and snags removed from the channel, and 1,022 trees and 221 cords of brush cut from the banks, '90, 1214.

1890-'91. 1,698 snags and logs and 44 cords of small snags removed from the channel, and 1,896 trees and 110 cords of brush cleared from the banks, '91, 1449.

1891-'92. 1,072 snags and logs and 47 cords of small snags removed from the channel, and 1,252 trees and 91 cords of brush cleared from the banks, '92, 1203.

**Projects.**

By Capt. W. H. Bixby, 1887, for improvement of the river by the removal of snags, trees, and similar obstructions, clearing it for a 4-foot draft steam navigation from its mouth to the Lumber River, and thence for a 4-foot draft pole-boat navigation to Little Rock, S. C.; estimated cost, \$50,000, '87, 1114; '91, 1448.

**Surveys.**

MAPS.

'90, 1214.

**PEMBROKE HARBOR, ME.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 31.

ENGINEER IN CHARGE.

Lieut. Col. J. A. Smith, 1889. Report, '89, 546.

**PEMBROKE HARBOR, ME.—Continued.****Physical Characteristics.**

Description of the locality, '89, 546.

**Plans.**

In 1889 Lieut. Col. Smith did not consider the harbor worthy of improvement, '89, 546.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Smith, '89, 546.

**PENOBSCOT RIVER, ME.—(See BANGOR HARBOR.)****PENSACOLA HARBOR, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 402.)

**Appropriations.**

1878-'87 .....	\$215,000
1888 .....	35,000, '88, 1166.
1890 .....	25,000, '90, 1630.
1892 .....	75,000, '92, 1415.

Total ..... 350,000

List of appropriations, '88, 1164; '89, 1377; '91, 1710.

**Commerce.**

Commerce of Pensacola, '91, 1729, 1734.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 152, 159; '89, 177, 184; '90, 159; '91, 202; '92, 198.

**BOARD OF ENGINEERS.**

Convened at Pensacola, Fla., July 16, 1891, by S. O. No. 5, to examine and report upon project for improvement of Pensacola Harbor. Report, '91, 1723. (Capts. Price, Black, and Carter.)

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1163, 1191.

Capt. P. M. Price, 1889-'— . Reports, '89, 1376, 1402; '90, 1627; '91, 1710, 1713; '92, 1412.

**ASSISTANT.**

J. E. Turtle. Reports, '89, 1378, 1408; '90, 1629; '91, 1715; '92, 1415.

**Operations.**

1887-'88. 1,718 tons stone received, of which 1,187 tons were placed in the north jetty, '88, 1165.

1888-'89. 839 tons stone placed in north jetty; 345 cubic yards of concrete blocks manufactured; piles driven and repairs made to plant, '89, 1379.

1889-'90. Operations upon north and south jetties continued, '90, 1629.

1890-'91. No operations pending revision of project, '91, 1711.

1891-'92. 14,151 cubic yards material dredged, '92, 1415.

**Physical Characteristics.**

Description of Pensacola Bay, '89, 1404, 1410; '91, 1723.

Winds, tides, currents, and tidal discharge, '89, 1405, 1408, 1412; '91, 1724, 1728.

Movement of beach line, '91, 1718, 1727.

Current velocities, '91, 1719.

**Plans.**

By Capt. Price, 1889, for formation of a channel through the outer and inner bars of Pensacola Harbor by construction of a concrete jetty on Calafaytas Shoals extending from the shore to the 23-foot curve and built to the height of mean high water; estimated cost, \$2,295,719, '89, 1406.

**Projects.**

By Capt. Damrell, 1879, as modified by Board of Engineers, 1881, for reestablishment of old shore line by construction of 4,000 linear feet brush and stone jetties in front of Fort McRae and deepening the channel across the inner bar by dredging to 24 feet depth by 300 feet width; estimated cost, \$150,000, '79, 101, 803, 810; '81, 1175; '84, 1162; '86, 1180. Failure of tides to maintain dredged channel. Total amount appropriated from 1878 to 1886, inclusive, \$215,000; estimated cost of completion of project, \$40,000, '87, 1269.

**PENSACOLA HARBOR, FLA.—Continued.****Projects—Continued.**

In 1888 it was estimated that \$60,000 would be required for completion, making the total cost of the work \$275,000, '88, 1164. This estimate was increased by \$81,000 in 1890, '90, 1630.

By Board of Engineers, 1891, to obtain a channel 24 feet deep at mean low water over the inner and outer bars by raising the shore arm of the western jetty to high water; raising the crest of the jetty from the shoulder to a point 5,000 feet out to the mean height of the beginning of ebb outflow; for the next 4,300 feet the crest to be brought up to mean low water; the shore arm of the eastern jetty to be raised to high water, the crest of the jetty then to sink within a distance of 1,200 feet to the level of the foundation course; the jetties to be constructed with a foundation course of brush mattress 100 feet wide and a superstructure of rubble stone capped with concrete; total estimated cost, including the removal of 500,000 cubic yards of material from the channel between the jetties, \$1,830,400, '91, 1731, 1732.

**Surveys.**

Resurvey of outer and inner bars ordered by act of August 5, 1886. Made, 1889, under direction of Capt. Price, '89, 1403; '91, 1715.

**MAPS.**

'90, 1630; '91, 1733.

**PENSAUKEE HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 403.)

**Appropriations.**

1882-'84 ..... \$15,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 237; '89, 276; '90, 249; '91, 319; '92, 305.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1841; '89, 2049; '90, 2333; '91, 2533.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2179.

**Operations.**

1887-'91. No operations since 1885, '88, 1842; '89, 2049; '90, 2333.

1891-'92. 600 linear feet of west end of pier repaired by hired labor, '92, 2179.

**Plans.**

Maj. Davis, 1890, reported that there existed no further commercial necessity for continuation of improvement, '90, 2333.

**Projects.**

By Lieut. Col. Robert, 1882, to secure a navigable channel from Green Bay into the Pensaukee River by construction of 2,500 linear feet of slab-pier work extending to the 10-foot curve, with dredging; to provide a channel of entrance, with an available depth of 10 and a width of 100 feet; estimated cost, \$50,000, '82, 2132; '83, 1650.

**PENSAUKEN CREEK, N. J.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 118.

**ENGINEER IN CHARGE.**

Maj. C. W. Raymond, 1890. Report, '91, 1100.

**Physical Characteristics.**

Description of the locality, '91, 1100.

**Plans.**

In 1890 Maj. Raymond did not consider the creek worthy of improvement, '91, 1100.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Raymond, '91, 1100.

**PENTWATER HARBOR, MICH.—IMPROVEMENT OF**

(Continued from Vol. II, p. 404.)

**Appropriations.**

1887-'87 .....	\$217, 820
1888 .....	8, 000, '88, 1908.
1890 .....	8, 000, '90, 2632.
1892 .....	5, 000, '92, 2330.

Total ..... 238, 820

List of appropriations, '92, 2330.

**Contracts.**

1889. Stephen Bedford, for white pine timber, at \$21 per M feet, B. M.; Geer & Crawford, for edgings, at \$3 per cord; Chicago and Lemont Stone Company, for stone, at \$8.24 per cord; Parkhurst & Wilkinson, for drift bolts, at \$2.05 per pound, '89, 2177. Weimer, Rath & Gaylord, for breakwater construction, at a total of \$5,239.62; Robert Finch, for dredging, at 17 cents per cubic yard, '89, 2178.

1890. Geer & Crawford, for edgings, at \$3 per cord, '90, 2633.

1891. Sands & Maxwell Lumber Company, for white pine timber, at \$18 per M feet, B. M.; white pine plank, at \$14 per M feet, B. M., and edgings, at \$3 per cord; Parkhurst & Wilkinson, for bolts and spike, at 2½ cents and 2½ cents per pound; F. A. Hagan, for stone, at \$2.24 per cord, '91, 2686.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 254; '89, 297; '90, 268; '91, 339; '92, 324.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1907.

Maj. W. Ludlow, 1889-'— . Reports, '89, 2176; '90, 2631; '91, 2684; '92, 2328.

**Operations.**

1887-'88. 50-foot pier extension under contract completed, '88, 1907.

1888-'89. No operations, '89, 2176.

1889-'90. 9,917 cubic yards material dredged; 612 linear feet sand fence built; repairs to piers, '90, 2632.

1890-'91. 7,200 cubic yards material dredged from channel between piers; 270 linear feet of south revetment rebuilt; repairs to north pier and south revetment, '91, 2685.

1891-'92. Repairs to south revetment completed, '92, 2329.

**Physical Characteristics.**

Description of the locality, '90, 2631.

**Projects.**

By Maj. Wheeler. 1866, for increasing width of the outlet to 150 feet, close piling the sides of the cut, extension of piers across the bar into Lake Michigan 1,280 feet, and dredging the channel between the piers to a depth of 12 feet, '67, 113; '68, 130.

Original estimate of 1866 amended, 1873, to \$192,020, '78, 1205; '87, 2186. From 1867 to 1882, inclusive, \$192,820 was appropriated.

In 1884 Capt. Lockwood considered that the completion of the improvement would require the construction of 300 linear feet of pier work, dredging at entrance and between piers, and repairs; estimated cost, \$70,000, '84, 1980.

In 1892 Maj. Ludlow proposed the addition of 4 cribs to the south pier (in completion of the existing project), and the reconstruction of 521 feet of north pier, 619 feet of south pier, and 417 feet of south revetment, 1,830 linear feet of sheet piling for north pier and south revetment, and dredging; estimated cost, \$53,000, '92, 2330.

**PEPPERELL COVE, ME.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 32, 614.

**ENGINEER IN CHARGE.**

Lieut. Col. J. A. Smith, 1890. Report, '91, 614.

**Physical Characteristics.**

Description of the locality, '91, 615.

**Plans.**

Lieut. Col. Smith did not consider the locality worthy of improvement, '91, 616.

**PETALUMA CREEK, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 405.)

**Appropriations.**

1880-'87 .....	\$30,000
1888 .....	2,000, '88, 2134.
1890 .....	4,000, '90, 2918.
1892 .....	10,000, '92, 2656.

Total ..... 46,000

List of appropriations, '92, 2655.

**Contracts.**

1891. M. J. Miller, for dredging, at 50 cents per cubic yard, '91, 3119.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 295; '89, 351; '90, 315; '91, 397; '92, 373.

ENGINEER IN CHARGE.

Maj. W. H. Heuer, 1888-'—. Reports, '88, 2133; '89, 2488; '90, 2917; '91, 3119; '92, 2655.

**Operations.**

1887-'88. Dredging channel completed under contract, '88, 2134.

1888-'91. No operations, '89, 2488; '90, 2917; '91, 3119.

1891-'92. 37,025 cubic yards material dredged from the channel, '92, 2656.

**Plans.**

By Maj. Heuer, 1888, for increasing the channel depth to 4 or 5 feet by removal of about 60,000 cubic yards of material, at an estimated cost of \$30,000, '88, 2134.

**Projects.**

By Lieut. Col. Mendell, 1879, for improvement of river below Petaluma by dredging the channel to a depth of 3 feet at low water, and also shortening the existing channel 5,320 feet by a cut 50 feet wide and 3 feet deep at low water; estimated cost, \$25,868. Total expenditure to completion of work in 1884 was \$27,656, '85, 2339; '87, 2446.

**PETIT JEAN RIVER, ARK.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 406.)

**Appropriations.**

1886-'87 .....	\$3,500
1888 .....	2,500, '88, 1401.
1892 .....	3,500, '92, 1683.

Total ..... 9,500

**Commerce.**

Prospective increase to result from improvement, '88, 1401.

Probable reduction in freight rates consequent upon improvement, '91, 2047.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 187; '89, 220; '90, 198; '91, 252; '92, 243.

ENGINEER IN CHARGE.

Capt. H. S. Taber, 1885-'—. Reports, '88, 1400; '89, 1652; '90, 1939; '91, 2046; '92, 1682.

**Operations.**

1887-'90. No operations, '88, 1401; '89, 1653; '90, 1940.

1890-'91. 599 snags and 340 cubic yards rock and gravel removed from the channel, and 4,079 trees cleared from the banks, '91, 2046.

1891-'92. No operations, '92, 1683.

**Projects.**

By Capt. Taber, 1885, for improvement of high-water navigation as far as Danville by removal of snags and similar obstructions; estimated cost, \$6,480, '85, 1630. Increased, 1888, to \$7,000, '88, 1401. Modified in 1889 to provide for the expenditure of \$2,500 below Rocky Crossing in removing timber from the low-water channel and a small portion of the ledges at Slaty Crossing and Robinsons Ridge, increasing the estimated cost of improvement to \$9,500, '89, 1653, 1654; '92, 1683.

**PETOSKEY HARBOR, MICH.—IMPROVEMENT OF.****Appropriations.**

1890..... \$15, 000, '91, 2671.  
 1892..... 20, 000, '92, 2315.

Total ..... 35, 000

**Commerce.**

Present and prospective commerce of the locality, '90, 2670.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 306; '90, 274; '91, 336; '92, 321.

**ENGINEERS IN CHARGE.**

Lieut. Col. S. M. Mansfield, 1888-'90. Report, '90, 2668.

Maj. W. Ludlow, 1890-'—. Reports, '90, 2673; '91, 2670; '92, 2314.

**ASSISTANT.**

Lieut. J. E. Kuhn. Report, '90, 2669.

**Physical Characteristics.**

Description of the locality, '90, 2674.

**Projects.**

By Maj. Ludlow, 1890, for construction of a breakwater extending 550 feet off shore from a point westward of the landing to 26 feet of water, and thence extending eastward about 1,200 feet, so as to overlap the landing and inclose a sheltered area open to the eastward of about 12 acres; estimated cost, \$170,000, '90, 2675; '91, 2671.

In 1892 the project was modified and limited to the reconstruction of the existing landing pier of solid crib work, with an arm extending eastward, at an estimated cost of \$70,000, '92, 2314.

**Surveys.**

Surveys for harbor of refuge ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Ludlow, '90, 2673.

**PHILADELPHIA HARBOR, PA.—(See DELAWARE RIVER AT PHILADELPHIA.)****PINE RIVER at Saint Clair City, Mich.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 319.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1888. Report, '89, 2282.

**Plans.**

In 1888 Col. Poe considered the existing channel facilities sufficient for existing commercial requirements, and did not recommend further improvements, '89, 2283.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2282.

**PISCATAWAY CREEK, MD.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 145, 1279.

**ENGINEER IN CHARGE.**

Lieut. Col. P. C. Hains, 1890. Report, '90, 1280.

**Physical Characteristics.**

Description of the locality, '91, 1280.

**Plans.**

In 1890 Lieut. Col. Hains did not consider that the local nature of the improvement warranted expenditure by the United States, '91, 1281.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Hains, '91, 1280.

**PISCATAWAY CREEK, VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 146, 1289.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1890. Report, '91, 1289.

**Physical Characteristics.**

Description of the locality, '91, 1289.

**Plans.**

In 1890 Lieut. Col. Hains did not consider the locality worthy of improvement, '91, 1290.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Hains, '91, 1290.

**PLATTSBURG HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 409.)

**Appropriations.**

1836-'87 .....	\$146, 180. 01
1888 .....	7, 000. 00, '88, 2097.
1890 .....	32, 500. 00, '90, 2879.

Total ..... 185, 680. 01

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 288; '89, 341, 343; '90, 307; '91, 385; '92, 364.

ENGINEER IN CHARGE.

Maj. M. B. Adams, 1885-'— Reports, '88, 2097; '89, 2447, 2458; '90, 2878; '91, 2931; '92, 2607.

**Operations.**

1887-'88. 25,000 cubic yards material dredged, '88, 2097.

1888-'89. No operations, '89, 2447.

1889-'90. 3,000 cubic yards material dredged, '90, 2878.

1890-'91. Extension of breakwater and renewal of timber superstructure in progress, '91, 2931.

1891-'92. Breakwater extension completed and superstructure construction in progress, '92, 2608.

**Physical Characteristics.**

Description of the locality, '89, 2458.

**Plans.**

By Maj. Adams, 1888, for repair of 1,250 linear feet of existing superstructure, and construction of 300 feet of additional breakwater; estimated cost, \$32,500, '89, 344, 2459.

**Projects.**

The earliest appropriation was made in 1836; between this date and 1844, under appropriations aggregating \$57,500, 854 linear feet of breakwater, covering the city wharves, were built, '66, iii, 17; iv, 1881.

Between 1864 and 1869 \$28,000 was expended in repairs, '66, i, 56; '67, 234; '68, 293; '69, 182.

In 1870 additional breakwater extension was undertaken and continued to 1875, during which time the breakwater was extended 400 feet, '71, 254; '72, 271; '73, 393; '74, i, 274; '75, i, 352.

Total appropriations from 1836 to 1886, inclusive, \$146,180.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Adams, '89, 2458.

**PLATTSMOUTH, NEBR.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)**



**PLEASANT RIVER, ME., from Columbia Falls to its mouth.—**  
IMPROVEMENT OF.

**Appropriations.**

1890..... \$3,500, '91, 574.

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '89, 32; '90, 26; '91, 20; '92, 24.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1888-'92. Reports, '90, 467; '91, 573.

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 498.

**ASSISTANT.**

F. S. Burrows. Report, '90, 470.

**Operations.**

1891-'92. Stone beacon built on "Channel Rocks," and an iron spindle established upon "Coffin Rocks;" 55 tons of rock removed from river above Addison Point, '92, 498.

**Physical Characteristics.**

Description of the locality, '90, 468.

**Projects.**

By Lieut. Col. Smith, 1890, for improvement of the river between Columbia Falls and its mouth by removal of rock ledges and the erection of three beacons to mark the position of dangerous rocks; estimated cost, \$3,500, '90, 470; '91, 574.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Lieut. Col. Smith, '90, 469.

**PLYMOUTH HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 409.)

**Appropriations.**

1824-'87 .....	\$172,066.90
1888.....	6,000.00, '88, 461.
1890.....	8,000.00, '90, 511.
1892.....	9,500.00, '92, 590.

Total ..... 185,566.90

List of appropriations, '92, 590.

**Contracts.**

1888. A. R. Wright, for dredging at 29½ cents per cubic yard, and for removal of boulders weighing over 3 tons, at \$10 per cubic yard, '89, 586.

1890. National Dredging Company, for dredging, at 27 cents per cubic yard, and removal of boulders of over 3 tons weight, at \$10 each, '91, 662.

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '88, 31; '89, 41, 43; '90, 35; '91, 44; '92, 50.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 459.

Lieut. Col. S. M. Mansfield, 1889-'—. Reports, '89, 584, 596; '90, 510; '91, 660; '92, 588.

**Operations.**

1887-'88. 8,312 cubic yards material dredged from basin and channel, '88, 460.

1888-'89. Breaches in plank bulkheads at Long Beach repaired by hired labor, '89, 585.

1889-'90. 13,000 cubic yards material dredged from the basin, '90, 511.

1890-'91. 6,918 cubic yards material dredged, '91, 662.

1891-'92. 11,586 cubic yards material dredged, and 1,300 linear feet of Long Beach bulkheads repaired, '92, 590.

**Plans.**

In 1888 Lieut. Col. Gillespie estimated the cost of improvement of Goose Point Channel by dredging and rock removal at \$40,000, and did not consider the improvement warranted by the commercial interests involved, '89, 597.

**Projects.**

Prior to 1875 appropriations were applied to the protection and preservation of Long Beach; the aggregate of appropriations from 1824 to 1874, inclusive, was \$103,566.90.

**PLYMOUTH HARBOR, MASS.—Continued.****Projects—Continued.**

By Lieut. Col. Thom, 1874, for dredging a channel 100 feet wide and 6 feet deep from the "Middle Ground" to "Long Wharf" at Plymouth, '75, ii, 414. Modified in 1876 to provide for dredging a basin 866 feet long, 150 feet wide, and 8 feet deep, in front of the town wharves, '76, i, 181; '77, 188; '78, 221; '81, 528.

In 1884-'85 it was proposed to widen the channel to 150 feet and deepen to 9 feet, '84, 516; '85, 511. The amount appropriated from 1875 to 1886, inclusive, was \$68,500, when it was estimated that \$15,500 would be required to complete existing project, '86, 65; '88, 460. Increased to \$17,500 in 1889, '89, 586.

**Surveys.**

Examination of Goose Point Channel ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Mansfield, '89, 596.

**Maps.**

'88, 460.

**POCOMOKE RIVER, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 410.)

**Appropriations.**

1878-'87 ..... \$20,500

List of appropriations, '88, 752.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 95; '89, 111.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885-'89. Reports, '88, 752; '89, 904.

**Operations.**

1887-'88. 53,386 cubic yards material dredged, completing the projected improvement, '88, 752.

1888-'89. No operations, '89, 904.

**Projects.**

By Lieut. Col. Craighill, 1878, for the formation of a dredged channel 7 feet deep, and removal of logs, snags, and obstructions; estimated cost, \$9,975, '79, 505, 510. Project completed in 1880, '81, 889.

By W. F. Smith, 1885, for excavation of a cut-off below Sand Hill 80 feet wide and 7 feet deep at mean low water, the length to be 1,100 feet; estimated cost, \$8,000, '85, 906; '88, 752. Project completed in 1888, '88, 752.

**POINT JUDITH, R. I.—BREAKWATER AT.****Appropriations.**

1890 ..... \$75,000, '91, 723.

1892 ..... 75,000, '92, 629.

Total ..... 150,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 56; '90, 51; '91, 58; '92, 62.

**ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1888-'92. Reports, '90, 592; '91, 722.

Capt. W. H. Bixby, 1892-'— . Report, '92, 628.

**Operations.**

1890-'91. Beacon established, and 3,000 tons of rock used in the construction of a portion of north and east arms of breakwater, '91, 722.

1891-'92. 8,630 tons riprap stone placed in breakwater, extending it 200 feet along both arms, '92, 629.

**Physical Characteristics.**

Description of the locality, '90, 594.

**Plans.**

By Maj. Livermore, 1889, for formation of a harbor at Point Judith by construction of a riprap granite breakwater along the course of Squid Ledge and between the southern extremity of the ledge and Point Judith, at an estimated cost of \$1,250,000, '90, 595.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Livermore, '90, 594.

**POINT JUDITH POND, R. I.—EXAMINATION FOR HARBOR OF REFUGE AT.****Appropriations.**

1892..... \$7,500

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 55.

ENGINEER IN CHARGE.

Maj. W. R. Livermore, 1888. Report, '89, 642.

**Physical Characteristics.**

Description of the locality, '89, 642.

**Plans.**

In 1888 Maj. Livermore did not consider the locality worthy of improvement to the extent of constructing a harbor of refuge, '89, 643.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Livermore, '89, 642.

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**PORT AUSTIN, MICH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 319.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1888. Report, '89, 2280.

**Plans.**

In 1888 Col. Poe did not consider the harbor worthy of improvement, '89, 2280.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2280.

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**PORTAGE LAKE, Manistee County, Mich.—IMPROVEMENT OF HARBOR OF REFUGE AT.**

(Continued from Vol. II, p. 412.)

**Appropriations.**

1879-'87..... \$82,500

1888..... 10,000, '88, 1902.

1890..... 8,000, '90, 2615.

Total..... 100,500

List of appropriations, '92, 2322.

**Contracts.**

1889. Truman &amp; Cooper, for dredging, at 10 cents per cubic yard, '89, 2170.

1891. Truman &amp; Cooper, for white pine plank, at \$17 per M feet, B. M.; Geer &amp; Crawford, for edgings, at \$2.50 per cord; F. A. Hagen, for stone, at \$2.24 per cord, '91, 2677.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 234, 253; '89, 274, 295; '90, 247, 266; '91, 316, 337; '92, 323.

BOARD OF ENGINEERS.

Convened at Houghton, Mich., December 11, 1890, by S. O. No. 40, to report upon establishment of harbor lines in Portage Lake. Report, '91, 2521. (Col. Poe, Maj. Quinn, and Capt. Marshall.)

ENGINEERS IN CHARGE.

Maj. C. E. L. B. Davis, 1887-'88. Report, '88, 1822.

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1903.

Maj. J. B. Quinn, 1888-'91. Reports, '89, 2027; '90, 2323.

Maj. Wm. Ludlow, 1889-'—. Reports, '89, 2168; '90, 2613.

**Legal Proceedings.**

Proceedings against mill owners on Portage Lake for deposit of refuse within harbor lines, '90, 2323.

**Operations.**

1887-'88. North pier extended 100 feet; 11,094 cubic yards material dredged, '88, 1903.

1888-'89. 23,000 cubic yards material dredged, '89, 2169.

1889-'90. 34,000 cubic yards material dredged, '90, 2614.

1890-'91. Repairs to revetments, '91, 2676.

1891-'92. No operations, '92, 2321.

**PORTAGE LAKE, Manistee County, Mich.**—Continued.**Obstructions.**

Deposit of material within the harbor lines of Portage Lake by stamp mills, '88, 1825.

**Physical Characteristics.**

Location and surroundings of Portage Lake Harbor, '90, 2613.

**Projects.**

By Maj. Mansfield, 1879, for the formation of a channel 300 feet wide and 18 feet deep to connect Lakes Michigan and Portage, the dredged channel to be protected by parallel pile and crib piers extending to the 18-foot curve in Lake Michigan; estimated cost, \$189,860, '79, 1634, 1636, 1638; '87, 2181.

Between 1879 and 1882 \$55,000 was appropriated. In 1883 Capt. Lockwood estimated for completion of original project \$210,000, '84, 1975; '92, 2322.

**PORTAGE LAKE AND LAKE SUPERIOR SHIP CANALS, MICH.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 411.)

**Appropriations.**

1886.....	\$10,000	
1890.....	\$20,000	} '92, 2166.
1892.....	\$350,000	
	50,000	

Total ..... 430,000

**Commerce.**

Tonnage and freight passing the Sault Sainte Marie and Saint Marys Falls canals from 1881 to 1890, inclusive, '92, 2159.

**Contracts.**

1892. Williams, Daugherty & Upham, for dredging, at 25 cents per cubic yard, '92, 2164.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 17; '92, 302.

ENGINEER IN CHARGE.

Maj. J. F. Gregory, 1891—'. Report, '92, 2158.

ASSISTANT.

Lieut. H. E. Waterman. Report, '92, 2166.

**Legislation.**

Act of September 19, 1890, providing for the close of the canals, '91, 17.

**Operations.**

1891-'92. 14,300 cubic yards material dredged from Lake Superior Canal entrance, '92, 2165. History of the Portage Lake canals, '92, 2160,

**Surveys.**

MAPS.

'92, Atlas, 102.

**PORT CHESTER HARBOR, N. Y.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 413.)

**Appropriations.**

1872-'82 .....	\$27,000
1888.....	5,000, '88, 568.
1890.....	5,000, '90, 651.
1892.....	5,000, '92, 703.

Total ..... 42,000

List of appropriations, '88, 568.

**Contracts.**

1889. S. & E. S. Belden, for riprap rock, at \$1.19 per ton, '89, 717.

1890. J. A. Bouker, for gneiss riprap, at \$1.07 per ton, '91, 799.

\* For maintenance of canals.

† For purchase of Portage canals.

**PORT CHESTER HARBOR, N. Y.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 53; '89, 66; '90, 59; '91, 73; '92, 77.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886'— Reports, '88, 567; '89, 715; '90, 650; '91, 797; '92, 702.

**Operations.**

1887-'88. No operations, '88, 567.

1888-'89. 3,698 tons stone placed in the breakwater, '89, 716.

1889-'90. No operations for lack of funds, '90, 651.

1890-'91. 3,369 tons of riprap delivered in the breakwater, '91, 793.

1891-'92. No operations, '92, 703.

**Physical Characteristics.**

Description of the harbor, '88, 567.

**Projects.**

By Lieut. Col. Newton, 1871, for removal of "sunken rock" to a depth of 9 feet; also construction of 400 linear feet of breakwater at Byram Point; estimated cost, \$96,632, '72, 809; '86, 652.

Modified in 1884 to provide for dredging a channel 3 feet deep at mean low water and 60 to 100 feet wide from the bay to the vicinity of the wharves, '84, 712; '86, 88, 652; '87, 621.

Estimate reduced to \$59,000 in 1890, or to \$25,000 for completion, '90, 651.

**Surveys.****MAPS.**

'89, 716.

**PORT CLINTON HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 414.)

**Appropriations.**

1872-'87 .....	\$58,000
1888 .....	5,000, '88, 1998.
1890 .....	3,000, '90, 2768.
1892 .....	10,000, '92, 2494.

Total ..... 76,000

List of appropriations, '92, 2494.

**Contracts.**

1889. John Stang, for dredging, at 25 and 26 cents per cubic yard, '89, 2306. John Stang, for pier and revetment repair, '89, 2307.

1890. Carlin, Stickney & Cram, for dredging, at 25 cents per cubic yard, '91, 2835.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 270; '89, 322; '90, 291; '91, 365; '92, 346.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1883-'92. Reports, '88, 1986; '89, 2305; '90, 2767; '91, 2835.

Lieut. Col. J. A. Smith, 1892'— Report, '92, 2494.

**Operations.**

1887-'88. Repairs to piers completed under contract, '88, 1987.

1888-'89. 9,025 cubic yards material dredged from harbor entrance, '89, 2306.

1889-'91. No operations for lack of funds, '90, 2767; '91, 2835.

1891-'92. 11,705 cubic yards material dredged, '92, 2494.

**Projects.**

By Maj. McFarland, 1871, for deepening, by dredging, the entrance to Portage River to a depth of 8 feet, and for the protection of the channel by 2 parallel piers; estimated cost, \$120,000, '71, 210; '80, 2100.

The efforts of 1872-'73 to maintain a channel by dredging having failed, in 1875 Lieut. Col. Blunt proposed a pile revetment from the north shore, and parallel and 200 feet distant an east pile pier extending to the 10-foot curve in the lake, '75, i, 295, 296; '80, 2100; '81, 2290.

From 1872 to 1886, inclusive, \$58,000 was appropriated, when it was estimated that \$41,000 would be required to complete the project, '86, 330; '92, 2494.

**Surveys.**

Examination of channel, 1889, '90, 2768.

**MAPS.**

'91, 2836.

**PORT DAY TO TONAWANDA, N. Y.**—(See NIAGARA RIVER.)**PORT JEFFERSON HARBOR, N. Y.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 415.)

**Appropriations.**

1852-'82 .....	\$80, 200
1890 .....	25, 000, '91, 816.
1892 .....	10, 000, '92, 71.

Total ..... 115, 200

List of appropriations, '88, 580.

**Contracts.**

1891. H. Toomey, for granite riprap, at \$1.50 per ton, '91, 817.

1892. R. Parrott, for dredging, at 21½ cents per cubic yard, '92, 717.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 70; '91, 76; '92, 80.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1886-'—. Reports, '88, 578; '89, 751; '91, 814; '92, 713.

**Operations.**

1887-'88. No operations; project completed, '88, 579, 580.

1890-'91. 1,464 tons of stone delivered upon east jetty, '91, 816.

1891-'92. 7,520 tons of riprap delivered in east and west jetties; 2,285 cubic yards material dredged, '92, 715.

**Physical Characteristics.**

Description of the harbor, '88, 578; '89, 751.

**Plans.**

By Col. Houston, 1888, for repair and enlargement of east and west jetties, and enlarging the channel, by dredging, to 200 feet width and 10 feet depth mean low water; estimated cost, \$90,000, '89, 754.

**Projects.**

By Maj. Warren, 1871, for the formation of a dredged channel of entrance 200 feet wide and 7 feet deep, protected by a breakwater 800 feet long, '71, 86, 804, 808. Modified in 1875 by the addition of an east jetty, '75, i, 105; ii, 265.

By Maj. Barlow, 1877, for completion of improvement by extension of jetties to 9-foot curve and excavation of channel between them to 8 feet at low water; estimated cost, \$34,000, '78, 407; '79, 359; '80, 468. Operations under this project were completed in 1883, '89, 752.

In 1889 Col. Houston proposed to make and maintain a 10-foot channel through the inlet by dredging and the repair and enlargement of the east and west jetties; estimated cost, \$90,000, '91, 815; '92, 714.

**PORTLAND, ME.**—IMPROVEMENT OF CHANNEL IN BACK COVE.

(Continued from Vol. II, p. 417.)

**Appropriations.**

1886 .....	\$26, 250
1888 .....	25, 000, '88, 388.
1890 .....	25, 000, '90, 448.
1892 .....	20, 000, '92, 521.

Total ..... 96, 250

List of appropriations, '90, 445.

**Commerce.**

Development of business in consequence of the improvement, '90, 445.

**Contracts.**

1889. Edward Moore, for dredging, at 22 cents per cubic yard, '89, 533.

1891. National Dredging Company, for dredging, at 11 cents per cubic yard, '91, 598.

**PORTLAND, ME.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 17; '89, 26; '90, 21; '91, 27; '92, 33.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'92. Reports, '88, 387; '89, 531; '90, 445; '91, 597.

Lieut. Col. P. C. Hains, 1892-'— . Report, '92, 520.

**Obstructions.**

Obstruction of Back Cove Channel by Grand Trunk Railroad Bridge, '90, 445.

**Operations.**

1887-'88. 49,602 cubic yards material dredged, '88, 388.

1888-'89. 114,130 cubic yards material dredged, '89, 531, 532.

1889-'90. 74,542 cubic yards material dredged, '90, 445.

1890-'92. No operations, '91, 597; '92, 520.

**Projects.**

By Maj. Smith, 1886, for widening and deepening the channel in Back Cove so as to afford a channel 300 feet wide and 12 feet deep at mean low water for a distance of about 5,600 feet along the harbor commissioners' line; estimated cost, \$181,000, '86, 542; '87, 452. Estimate reduced to \$180,000, '88, 387; '92, 520.

**Surveys.****MAPS.**

'88, 388.

**PORTLAND HARBOR, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 416.)

**Appropriations.**

1836-'87 .....	\$466,477.05
1888 .....	40,000.00, '88, 386.
1890 .....	40,000.00, '90, 445.
1892 .....	30,000.00, '92, 519.

Total ..... 576,477.05

List of appropriations, '89, 530.

**Contracts.**

1888. Moore & Wright, for dredging, at 34 cents per cubic yard for hard and 17 cents per cubic yard for soft material, '89, 531.

1891. Moore & Wright, at 19 cents per cubic yard for hard and 9½ cents for soft material, '91, 596.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 16; '89, 25; '90, 21; '91, 27; '92, 32.

**ENGINEER IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'— . Reports, '88, 385; '89, 529; '90, 444; '91, 595; '92, 517.

**Operations.**

1887-'88. 169,872 cubic yards material dredged from channel, '88, 386.

1888-'89. 77,792 cubic yards soft material and 61,265 cubic yards hard sand dredged, '89, 530.

1889-'90. No operations, '90, 444; '91, 595.

1891-'92. Dredging in continuation of the 29-foot channel, '92, 519.

**Projects.**

The appropriations of 1836, 1837, and 1838, aggregating \$61,336, were applied toward the partial construction of 1,763 linear feet of breakwater on Stanfords Ledge, '78, 199; '79, 255.

From 1866 to 1884, inclusive, \$375,111.05 was appropriated and applied to the completion of the breakwater to a length of 2,005 feet, the deepening of the lower harbor, by dredging, to 21 feet, and to 16 feet as far up as Browns Wharf, and a small channel in the Back Cove to a depth of 8 feet, '79, 256; '86, 57, 538; '87, 451.

In 1886 Maj. Smith proposed increasing, by dredging, the channel approaching the lower wharves to a width of 500 feet and a depth of 29 feet, at an estimated cost of \$135,000, '86, 540, '87, 449. Total expenditure to 1888, \$30,000. Amount required to complete project, \$105,000, '88, 385, 386. Modified in 1889 to include deepening the water front in the upper part of the harbor to 16 feet; estimated additional cost, \$5,000, '90, 444; '92, 518.

**PORT ORFORD, OREG.—EXAMINATION FOR HARBOR OF REFUGE.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 411.

BOARD OF ENGINEERS.

Convened at San Francisco, October 27, 1890, by S. O. No. 66, to consider and report upon the proposed harbor of refuge at Port Orford, Oreg. Report, '91, 3305. (Col. Mendell, Maj. Handbury, and Capt. Symons.)

**Plans.**

For plans and estimates considered by the Board see '91, 3306.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '91, 3305.

**PORT SANILAC, MICH.—EXAMINATION FOR HARBOR OF REFUGE AT.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 319.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1888. Report, '89, 2284.

**Physical Characteristics.**

Description of the locality, '89, 2285.

**Plans.**

In 1888 Col. Poe did not consider Port Sanilac worthy of improvement as a harbor of refuge, '89, 2285.

**Surveys.**

Examination for harbor of refuge ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2284.

**PORTSMOUTH HARBOR, N. H.—IMPROVEMENT OF.**

(See also LITTLE HARBOR, N. H.)

(Continued from Vol. II, p. 418.)

**Appropriations.**

1879-'87 .....	\$107, 000
1888 .....	15, 000, '88, 395.
1890 .....	13, 000, '90, 451.

Total .....	135, 000
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List of appropriations, '88, 394; '89, 539.

**Contracts.**

1889. O. J. Jennings, for rock removal, at \$11 per cubic yard, '89, 540.

1891. T. Symonds, for rock removal, at \$13 per cubic yard, '91, 605.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 20; '89, 29; '90, 24; '91, 30; '92, 36.

ENGINEERS IN CHARGE.

Lieut. Col. J. A. Smith, 1886-'92. Reports, '88, 394; '89, 539; '90, 450; '91, 604.

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 527.

**Operations.**

1887-'88. 632 cubic yards rock removed, '88, 394.

1888-'89. No operations, '89, 539.

1889-'90. 168 cubic yards rock removed, '90, 451.

1890-'91. 244 cubic yards rock removed, '91, 604.

1891-'92. Project completed, '92, 528.

**Projects.**

By Lieut. Col. Thom, 1879, for improvement of Portsmouth Harbor by construction of a breakwater 820 feet in length between Great and Goat islands; also for removal of Gangway Rock to a depth of 20 feet, and of a part of the ledge off Badgers Rock to a depth of 10 feet mean low water, at a total estimated cost of \$150,000, '79, 48, 261, 282.

In 1882 Col. Thom did not consider the completion of the proposed breakwater a public necessity, '84, 474.

All contemplated improvements completed and no further appropriation needed, '92, 528.



**PORT WASHINGTON HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 419.)

**Appropriations.**

1870-'87 .....	\$169,500
1888 .....	5,000, '88, 1857.
1890 .....	3,000, '90, 2350.
1892 .....	6,500, '92, 2197.

Total ..... 184,000

List of appropriations, '92, 2197.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 242; '89, 281; '90, 253; '91, 324; '92, 310.

ENGINEERS IN CHARGE.

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1856; '89, 2065; '90, 2349; '91, 2551.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2196.

**Operations.**

1887-'88. 50 linear feet of superstructure built upon Crib No. 17, north pier, '88, 1857.

1888-'89. 3,510 cubic yards material dredged by hired labor, '89, 2066.

1889-'90. 25,525 cubic yards material dredged, and repairs to north pier made by hired labor, '90, 2349.

1890-'91. 9,485 cubic yards material dredged from entrance channel and basins, '91, 2551.

1891-'92. 14,360 cubic yards of material dredged; 40 cords of stone used in refilling pier heads, '92, 2197.

**Projects.**

By Maj. Wheeler, 1869, for two parallel crib piers 200 feet apart, extending to 14 feet in the lake, with the dredging of a channel between the piers 12 feet deep and the excavation and revetment of a (west) river basin; estimated cost, \$154,527, '70, 119; '76, ii, 381. Modified in 1870 by changing direction of piers and reducing the width between them to 150 feet, '73, 207; '76, ii, 380. Again modified in 1876 to provide for the excavation of a basin on the north side of the channel 700 by 200 feet and 12 feet deep, '76, ii, 380; '77, 866. Total estimated cost of project of 1869, with modifications of 1870 and 1876, \$181,500, '77, 866; '83, 1693; '87, 2050.

**POTOMAC CREEK, VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 146, 1285.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1890. Report, '91, 1285.

**Physical Characteristics.**

Description of the locality, '91, 1285.

**Plans.**

In 1890 Lieut. Col. Hains did not consider existing commerce sufficient to justify an improvement of the creek, '91, 1286.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Hains, '91, 1286.

**POTOMAC RIVER in vicinity of Washington, D. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 421.)

**Appropriations.**

1833-'87 .....	\$1,716,500
1888 .....	300,000, '88, 777.
1890 .....	280,000, '90, 1040.
1892 .....	200,000, '92, 1037.

Total ..... 2,496,500

List of appropriations, '90, 1038.

**POTOMAC RIVER in vicinity of Washington, D. C.—Continued.****Contracts.**

1888. F. W. Smith, for lumber, at \$34.50 per M feet, B. M.; D. H. Shoemaker, for broken stone, at from \$1.40 to \$1.55 per cubic yard; E. E. Burroughs, for sand, at 75 cents per cubic yard, and pebbles, at \$1.20 per cubic yard; C. S. Beebe, for piles, at 7 cents per linear foot, '88, 789.
1889. H. Wilson, for dredging, at 11½ cents per cubic yard; T. P. Morgan, for dredging, at 22 cents per cubic yard, '89, 987. California Hydraulic Dredging and Reclamation Company, for dredging, at 12½ cents per cubic yard, '89, 988.
1890. J. H. McGill, for cement, at \$2.34 per barrel; F. C. Somers, for dredging, at 20 cents per cubic yard, '90, 1041.
1891. F. C. Somers, for dredging, at 17.9 cents per cubic yard; W. H. Mohler, for building stone, at \$1.70 per cubic yard; F. C. Somers, for dredging, at 15½ cents per cubic yard, '91, 1251.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 104; '89, 121; '90, 108; '91, 135, 146; '92, 136, 147.

**ENGINEERS IN CHARGE.**

Lieut. Col. P. C. Hains, 1883-'92. Reports, '88, 777, 782; '89, 983; '90, 1037, 1042, 1045; '91, 1246; '92, 1070.

Maj. C. E. L. B. Davis, 1892-'—, Report, '92, 1030.

**ASSISTANT.**

L. R. Grabill. Report, '92, 1074.

**Operations.**

- 1887-'88. 1,192,112 cubic yards material dredged from river bed and deposited upon the flats; excavation of tidal reservoir continued, and cofferdam built and placed, '88, 779, 781.
- 1888-'89. Dredging in Washington Channel continued; embankments maintained along margin of the fill, and construction of the reservoir outlet resumed, '89, 984.
- 1889-'90. Masonry of reservoir outlet completed, and cut dredged through Virginia Channel Bar, '90, 1039.
- 1890-'91. 5,100 linear feet of dry stone wall built; erection of embankments along margin of reclaimed flats, '91, 1247.
- 1891-'92. 8,740 linear feet of stone sea wall built; 352,027 cubic yards material dredged from the Virginia Channel; dredging continued in the Washington Channel; 90,217 cubic yards material dredged from Anacostia River Channel; reservoir outlet and wing walls completed, '92, 1033-1035.

**Physical Characteristics.**

Description of condition of the river prior to improvement, '88, 778; '89, 984.

Freshet of June 2, 1889, '89, 985.

**Plans.**

Special report by Lieut. Col. Hains on separating the wagon road from the railroad on the north side of main channel of the Potomac River, '90, 1042. Also as to the most suitable kind of bridge from foot of New York avenue across the Potomac River to Arlington, '90, 1042.

By Lieut. Col. Hains, 1891, for the formation of a channel 200 feet wide and 24 feet deep at low tide through five bars up to Georgetown; estimated cost, \$300,000, '92, 1072.

**Projects.****WASHINGTON AND GEORGETOWN HARBORS.**

In 1833 an appropriation of \$150,000 was made for the removal of obstructions in Potomac River, the purchase of Little Falls Bridge, and the construction of a turnpike road, '79, 591.

In 1870 it was proposed to secure a depth of 16 feet at low water to Georgetown and along the wharves of the Washington Harbor from Arsenal Point to Long Bridge, and the removal of the most dangerous obstructions in Georgetown Harbor, '70, 534; '71, 592, 595; '83, 776; '86, 135.

In 1882 this improvement was merged in that of the improvement of the Potomac River at Washington, '82, 990, 992.

**POTOMAC RIVER.**

In 1882 a Board of Engineers recommended the widening and deepening of the channels between Giesborough Point and Easbys Point, so as to accommodate the largest vessels that can reach the former locality; the reclamation of the flats and marshes along the city front, between Easbys Point and the Arsenal, by depositing thereon material dredged from the channels; the establishment of harbor lines beyond which wharves shall not be built; the removal or rebuilding of Long Bridge; the interception of sewage now discharged into the navigation channel, and its conveyance to James Creek; estimated cost, \$2,500,000, '82, 990; '83, 780.

**POTOMAC RIVER in vicinity of Washington, D. C.—Continued.****Projects—Continued.****POTOMAC RIVER—Continued.**

In 1883 the estimate was increased to \$2,716,365, '83, 794.

In 1885 Maj. Hains proposed a modification of height of filling over reclaimed areas below Long Bridge, and the omission of the surrounding levee and drainage system; also the construction of a tidal reservoir for flushing the canal sewer, '85, 939. Approved by Board of Engineers, 1885, '85, 942.

In 1891 \$881,365 was estimated as required for completion of the improvement, '91, 1249; '92, 1030.

**Surveys.**

Survey of the Potomac River up to Washington ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Hains, '92, 1070.

**MAPS.**

'88, 782; '89, 986; '90, 1038; '91, 1248; '92, Atlas, 17.

**POTOMAC RIVER, EASTERN BRANCH (ANACOSTIA RIVER), D. C.—IMPROVEMENT OF.****Appropriations.**

1890..... \*\$20,000, '92, 1035.

**Contracts.**

1891. F. C. Somers, for dredging, at 17.9 cents per cubic yard, '92, 1035.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 124; '91, 146; '92, 138, 146, 398.

**BOARD OF ENGINEERS.**

Convened at Washington, D. C., May 16, 1892, by S. O. No. 10, to report upon establishment of harbor lines in Anacostia River. Report, '92, 1080. (Col. Craighill, Lieut. Col. Elliot, and Maj. Davis.)

**ENGINEERS IN CHARGE.**

Lieut. Col. P. C. Hains, 1888-'92. Report, '89, 993.

Maj. C. E. L. B. Davis, 1892-'— Report, '92, 1035, 1064, 1079.

**Operations.**

1891-'92. 90,217 cubic yards material dredged, '92, 1035.

**Physical Characteristics.**

Description of the locality, '92, 1065.

**Plans.**

In 1888 Lieut. Col. Hains did not consider the Eastern Branch of the Potomac worthy of improvement, '89, 993.

**Projects.**

By Lieut. Col. Hains, 1891, for improvement of Anacostia River by excavation of a channel 200 feet wide and 20 feet deep (ultimately to be increased to 24) from the mouth to the navy-yard bridge, with a basin in front of the yard 400 feet wide and 20 feet deep; this channel to be widened at a reduced depth to 1,000 feet as the demands of commerce require in the future; total amount of material to be dredged, 4,100,000 cubic yards; estimated cost, \$656,000, '92, 1068.

**Surveys.**

Survey of Anacostia River (Eastern Branch of the Potomac) ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Davis, '92, 1065.

**POTOMAC RIVER at Mount Vernon, Va.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 423.)

**Appropriations.**

1879-'81..... \$8,500

1888..... 6,000, '88, 814.

1890..... 2,500, '90, 1061.

Total..... 17,000

List of appropriations, '88, 814, 1000.

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\*From appropriation for improving Potomac River.

**POTOMAC RIVER at Mount Vernon, Va.—Continued.****Contracts.**

1888. F. C. Somers, for dredging, at 11½ cents per cubic yard, '89, 999.

1891. F. C. Somers, for dredging, at 11½ cents per cubic yard, '91, 1253.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 108; '89, 125; '90, 112; '91, 138; '92, 138.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1879-'91. Reports, '88, 813; '89, 999; '90, 1061.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1252.

Maj. C. E. L. B. Davis, 1892-'— . Report, '92, 1038.

**Operations.**

1887-'88. No operations for lack of funds, '88, 814.

1888-'89. 38,296 cubic yards material dredged, '89, 999.

1889-'90. No operations for lack of funds, '90, 1061.

1890-'91. 12,846 cubic yards material dredged, '91, 1253.

1891-'92. No operations; improvement completed, '92, 1039.

**Projects.**

By S. T. Abert, 1879, for the formation of a dredged channel from deep water in the Potomac to the wharf at Mount Vernon 15 feet wide and 7 feet deep, with a suitable turning basin at the wharf; estimated cost, \$14,000, '79, 598, 599; '86, 139.

The necessity for further deepening in 1886 increased this estimate to \$17,000, '86, 139; '88, 1000.

In 1888 the project was amended so as to provide for a channel 200 feet wide, and from 9 to 10 feet deep, with a turning basin of 200 feet radius; total cost of amended project, \$26,000, '91, 1252.

In 1892, after an expenditure of \$17,000, the dimensions of the channel were considered sufficient for the needs of existing navigation and no further work was recommended, '92, 1039.

**Surveys.****MAPS.**

'89, 1000; '90, 1061.

**POTOMAC RIVER.—CONSTRUCTION OF FISH WAYS AT GREAT FALLS OF.**

(Continued from Vol. II, p. 420.)

**Appropriations.**

1882..... \$50,000

1888..... 25,000, '88, 2776.

Total ..... 75,000

**Contracts.**

1891. T. H. Hathaway, for construction of fish ways, at a total of \$31,908, '91, 3906.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 312; '89, 380; '90, 348; '91, 443; '92, 417.

**ENGINEERS IN CHARGE.**

Maj. G. J. Lydecker, 1883-'89. Report, '88, 2776.

Col. J. M. Wilson, 1889-'90. Report, '89, 2825.

Lieut. Col. G. H. Elliot, 1890-'—. Reports, '90, 3532; '91, 3905; '92, 3382.

**Operations.**

1887-'91. No operations, '88, 2766; '89, 2825; '90, 3532.

1891-'92. Fish ways in process of construction, '92, 3382.

**Projects.**

By Maj. Lydecker, 1883, for erection of fish ways at Great Falls of the Potomac River; estimated cost, \$34,160, '85, 2499; '87, 2565.

**POTOMAC RIVER, SOUTH BRANCH, W. VA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 124.

**ENGINEER IN CHARGE.**

Lieut. Col. P. C. Hains, 1888. Report, '89, 994.

**POTOMAC RIVER, SOUTH BRANCH, W. VA.—Continued.****Physical Characteristics.**

Description of the locality, '89, 994.

**Plans.**

In 1888 Lieut. Col. Hains did not consider the South Branch of the Potomac River worthy of improvement, '89, 994.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Hains, '89, 994.

**POTOMAC RIVER.—EXAMINATION OF CHANNEL CROSSING FROM ALEXANDRIA, VA., TO THE MARYLAND SIDE.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 134.

ENGINEER IN CHARGE.

S. T. Abert, U. S. agent, 1888. Report, '89, 1029.

**Plans.**

In 1888 Mr. S. T. Abert did not consider the locality worthy of improvement, '89, 1029.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Mr. S. T. Abert, '89, 1029.

**POWOW RIVER, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 424.)

**Appropriations.**

1888.....	\$3,000, '88, 24.
1890.....	5,000, '90, 486.
1892.....	4,000, '92, 556.

Total ..... 12,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 24; '89, 33; '90, 28; '91, 35; '92, 41.

ENGINEER IN CHARGE.

Lieut. Col. S. M. Mansfield, 1889—'. Reports, '89, 558; '90, 485; '91, 630; '92, 556.

**Operations.**

1887-'90. Operations deferred pending the insertion of a draw in bridge at Salisbury, '88, 24; '89, 558; '90, 486; '91, 630; '92, 556.

**Projects.**By Maj. Raymond, 1885, for the formation of a dredged channel 60 feet wide and 12 feet deep at mean high water between Amesbury and the mouth, a distance of  $1\frac{1}{2}$  miles, at an estimated cost of \$77,000, '85, 551; '89, 558; '91, 630.**PRESQUE ISLE PENINSULA, ERIE HARBOR, PA.—PRESERVATION AND PROTECTION OF.****Appropriations.**

1888..... \$60,000, '88, 278.

**Contracts.**

1888. J. Friday, for construction of shore protection, at a total of \$75,830, '89, 2356.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 278; '89, 329; '90, 298; '91, 374; '92, 353.

BOARD OF ENGINEERS.

Convened at New York City, January, 1890, to examine and report upon Capt. Mahan's project for shore protection. Report, '90, 2800. (Cols. Abbot and Comstock and Lieut. Col. Gillespie.)

**PRESQUE ISLE PENINSULA, ERIE HARBOR, PA.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Capt. F. A. Mahan, 1888-'90. Report, '89, 2353.

Maj. A. Stickney, 1890-'92. Reports, '90, 2799; '91, 2877.

Maj. E. H. Ruffner, 1892-'— Report, '92, 2526.

**Operations.**

1887-'88. No operations, '88, 278.

1888-'89. 805 linear feet of shore protection built, '89, 2354.

1889-'90. 3,695 linear feet of shore protection built, '90, 2800.

1890-'92. No operations, '91, 2878; '92, 2527.

**Physical Characteristics.**

Description of locality, '90, 2801.

**Plans.**

By Capt. Mahan, 1889, for 6,000 linear feet of crib protection, at an estimated cost of \$360,000, '90, 2800.

**Projects.**

By Capt. Maguire, 1885, for protection of the peninsula by a pile and sheet pile protection 6,000 feet long parallel with and about 100 feet from the shore; estimated cost, \$173,000, '89, 2353, 2355.

In 1890 this project was abandoned, and it was recommended by the Board of Engineers that \$20,000 be held in reserve to repair any possible breach through the peninsula, the further construction of shore protection being considered inadvisable, '90, 2803, 2804. (Cols. Abbot and Comstock and Lieut. Col. Gillespie.)

**Surveys.****MAPS.**

'89, 2354.

**PRIME HOOK CREEK, DEL.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 112.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1888. Report, '89, 905.

**ASSISTANT.**

A. Stierle. Report, '89, 905.

**Physical Characteristics.**

Description of the locality, '89, 906.

**Plans.**

In 1888 Mr. W. F. Smith did not consider the creek worthy of improvement, '89, 905.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of W. F. Smith, '89, 905.

**PRINCESS BAY, STATEN ISLAND, N. Y.—EXAMINATION FOR  
BREAKWATER AT.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 107.

**ENGINEER IN CHARGE.**

Capt. T. L. Casey, 1890. Report, '91, 1013.

**Plans.**

In 1890 Capt. Casey did not consider that the limited commercial interests of the locality warranted any improvement, '91, 1014.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Casey, '91, 1013.

**PROVIDENCE RIVER AND NARRAGANSETT BAY, R. I.—  
IMPROVEMENT OF.**

(Continued from Vol. II, p. 425.)

**Appropriations.**

1852-'87 .....	\$534, 000
1888.....	40, 000, '88, 499.
1890.....	50, 000, '90, 570.
1892.....	50, 000, '92, 620.

Total ..... 674, 000

List of appropriations, '92, 620.

**Contracts.**

1891. C. & H. E. DuBois, for dredging, at 9 cents per cubic yard, '91, 714.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 39; '89, 49; '90, 44; '91, 54; '92, 59.

ENGINEERS IN CHARGE.

Maj. W. R. Livermore, 1887-'92. Reports, '88, 498; '89, 623; '90, 568; '91, 712.

Capt. W. H. Bixby, 1892-'— . Report, '92, 618.

**Operations.**

1887-'88. 199,580 cubic yards of material dredged, completing the excavation of the 20-foot anchorage area, '88, 499.

1888-'89. No operations, '89, 623.

1889-'90. 96,031 cubic yards mud dredged, '90, 570.

1890-'91. 140,673 cubic yards material dredged, '91, 713.

1891-'92. 87,776 cubic yards material dredged, '92, 620.

**Projects.**

The early project dates from the first appropriation in 1852, and proposed, by dredging, the formation of a channel at the "Crook" and "Point of Long Bar" 9 feet deep at mean low water; under subsequent appropriations to 1874 it was expanded to depths of 12 and 14 feet, together with the removal of Bulkhead Rock. The amount appropriated between 1852 and 1883, inclusive, was \$59,000, '71, 728; '79, 307, 730, 734; '80, 383; '81, 82.

No appropriations were made between 1873 and 1878.

The approved project of 1878, modified by Lieut. Col. Warren in 1882, provides for a channel 25 feet deep and 300 feet wide, suitable for large ocean vessels, extending from Fox Point, in the city of Providence, to the deep water of Narragansett Bay, and for an anchorage basin between Fox and Fields points, with cross-section dimensions from 300 feet width and 25 feet depth to 1,060 feet width and 6 feet depth; estimated cost, \$675,000; amount estimated for completion in 1889, \$165,000, '89, 625; '91, 712; '92, 619.

**PROVIDENCE RIVER, R. I.—REMOVAL OF GREEN JACKET SHOAL AT  
PROVIDENCE.**

(Continued from Vol. II, p. 424.)

**Appropriations.**

1886-'87 .....	\$26, 250
1888.....	28, 000, '88, 501.
1890.....	25, 000, '90, 572.
1892.....	10, 000, '92, 623.

Total ..... 89, 250

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 40; '89, 50; '90, 45; '91, 55; '92, 59.

ENGINEER IN CHARGE.

Maj. W. R. Livermore, 1888-'—. Reports, '88, 500; '89, 626; '90, 571; '91, 715; '92, 621.

**Operations.**

1887-'88. 206,431 cubic yards material dredged, '88, 501.

1888-'89. No operations, '89, 627.

1889-'90. 147,520 cubic yards material dredged, '90, 572.

1890-'91. No operations, '91, 716.

1891-'92. 125,104 cubic yards material dredged, '92, 622.

**PROVIDENCE RIVER, R. I.—Continued.****Physical Characteristics.**

Description of the locality, '89, 626.

**Projects.**

By Lieut. Col. Elliot, 1885, for the removal, by dredging, of Green Jacket Shoal, in the harbor of Providence, to a depth of 25 feet at mean low water; estimated cost, \$112,346, '85, 602; '86, 75, 605; '87, 553; '92, 621, 622.

**PROVINCETOWN HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 426.)

**Appropriations.**

1826-'87 .....	\$172,328.44
1888 .....	7,000.00, '88, 463.
1890 .....	7,500.00, '90, 515.
1892 .....	1,500.00, '92, 594.

Total ..... 188,328.44

List of appropriations, '92, 594.

**Commerce.**

Benefits to commerce by maintenance of a harbor of refuge, '88, 462.

**Contracts.**

1888. C. H. Edwards, for delivery of stone, at \$1.38 per ton, and brush, at \$4 per cord, '89, 591.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 32; '89, 42; '90, 36; '91, 45; '92, 51.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 462.

Lieut. Col. S. M. Mansfield, 1889-'—. Reports, '89, 589; '90, 513; '91, 665; '92, 593.

**Operations.**

1887-'88. 232 linear feet of jetty and 257 linear feet of sand catches built, '88, 462.  
1888-'89. 770 tons stone and 135 cords of brush delivered in Long Point Bulkhead, '89, 590.

1889-'90. 1,118 tons stone and 150 cords of brush delivered in Long Point Bulkhead; 60-foot breach near Abel Hill Dike closed with plank bulkhead, '90, 514.

1890-'91. Bulkhead construction at Long Point by hired labor, '91, 666.

1891-'92. Breakwater protecting the easterly shore of Long Point extended 150 feet; Long Point Bulkhead completed; repairs to brush and wood sand catches at Abel Hill Dike, '92, 593.

**Projects.**

The object for which appropriations have been made is the prevention or arrest of the movement of sand by the wind and waves, and the consequent protection of Provincetown Harbor by the perpetuation of its low shore lines. The works of preservation have consisted mainly of detached bulkheads of timber and stone, jetties of wood and brush, dikes, sand-catch fences, and beach grass planting. The earliest appropriation was made in 1826; between this date and 1864 \$32,850 was appropriated for the construction of jetties and sand catches, '66, iii, 28.

In 1866 the project for the protection of Beach Point and Long Point by the construction of bulkhead jetties was adopted, '66, ii, 29; '67, 464.

In 1869 the construction of a dike at High Head was undertaken to prevent a breach through the outer beach across the salt meadows and East Harbor Creek, '69, 60, 420.

In 1872 a dike was built at Abel Hill across the head of Lancy Harbor to prevent the flow of the tide and sand into the inner harbor, '72, 950.

Under subsequent appropriations the works of protection have been extended and maintained.

From 1864 to 1886, inclusive, \$139,478.44 was appropriated, '86, 575; '87, 528. From the nature of the work it can at no time be considered completed, '88, 462; '92, 593.



**PULTNEYVILLE HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 427.)

**Appropriations.**

1870-'87 .....	\$71,000
1890 .....	2,000, '91, 2905.
1892 .....	1,000, '92, 2562.

Total ..... 74,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 379; '92, 358.

**ENGINEERS IN CHARGE.**

Capt. C. F. Palfrey, 1887-'91. Report, '88, 2073.

Capt. D. C. Kingman, 1891-'—. Reports, '91, 2903; '92, 2557.

**Operations.**

1887-'91. No operations, '88, 2074;

1891-'92. 200 linear feet of sand-tight sheet pile jetty constructed, '92, 2561.

**Projects.**

By Maj. Bowen, 1872, for construction of a pier to be connected with the western shore by a breakwater, both to be 20 feet wide; also for dredging, at an estimated cost of \$27,000. Modified in 1872 by the addition of an east pier parallel to and 200 feet from the west pier, '72, 255. The original project for the formation of a harbor was estimated to cost \$59,000, '74, i, 250, but was subsequently increased in 1875 to \$71,000, '75, i, 334; '84, 2138.

Total amount appropriated from 1870 to 1886, inclusive, \$71,000.

**PUNGO RIVER to Sladesville, N. C.—EXAMINATION FOR WATERWAY.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 170, 1418.

**ENGINEER IN CHARGE.**

Capt. W. H. Bixby, 1890. Report, '91, 1418.

**ASSISTANT.**

Lieut. M. M. Patrick. Report, '91, 1420.

**Physical Characteristics.**

Description of the locality, '91, 1418.

**Plans.**

In 1890 Capt. Bixby did not consider the locality worthy of improvement, '91, 1419.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Bixby, '91, 1418.

**PUNTA RASSA HARBOR, FLA.—SURVEY OF.****Commerce.**

Commercial interests of the harbor, '88, 1156.

**Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 151.

**ENGINEER IN CHARGE.**

Capt. W. M. Black, 1886. Report, '88, 1157.

**ASSISTANT.**

J. W. Sackett. Report, '88, 1156.

**Physical Characteristics.**

Description of the locality, '88, 1155.

**Projects.**

By Capt. Black, 1887, for improvement of Punta Rassa Harbor by excavation of a channel 11 feet deep and 200 feet wide through the bar at the harbor entrance, involving the removal of 70,000 cubic yards of material, at an estimated cost of \$40,643, '88, 1156.

**Surveys.**

Survey ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Black, '88, 1155.

**PUYALLUP RIVER, WASH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 409, 3255.

ENGINEER IN CHARGE.

Capt. T. W. Symons, 1890. Report, '91, 3255.

ASSISTANT.

J. A. McMillan. Report, '91, 3257.

**Plans.**

In 1890 Capt. Symons did not consider the locality worthy of improvement, '91, 3256.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Symons, '91, 3256.

**QUANICASSEE RIVER, MICH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 319.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1888. Report, '89, 2284.

**Plans.**

In 1888 Col. Poe did not consider the river worthy of improvement by the General Government, '89, 2284.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Col. Poe, '89, 2284.

**QUANTICO CREEK, VA.—EXAMINATION OF.**

(Continued from Vol. II, p. 429.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 135.

ENGINEER IN CHARGE.

Mr. S. T. Abert, U. S. agent, 1888. Report, '89, 1030.

**Physical Characteristics.**

Description of the locality, '89, 1030.

**Plans.**

In 1888 Col. Craighill did not consider the locality worthy of improvement, '89, 1030.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Mr. S. T. Abert, '89, 1030.

**RACCOON RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 429.)

**Appropriations.**

1882..... \$3,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 84.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert, 1885-'88. Report, '88, 712.

**Operations.**

1887-'88. No operations, '88, 712.

**Plans.**

By Col. Weltzel, 1883, for improvement of Raccoon River by excavation of a channel 3 feet deep at low water, with a bottom width of 40 feet from the mouth up to Swedesboro Railroad Bridge; estimated cost, \$17,940, '83, 649; '87, 810.

**RACINE HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 429.)

**Appropriations.**

1844-'87 .....	\$237, 285
1888 .....	10, 000, '88, 1865.
1890 .....	17, 000, '90, 2358.
1892 .....	25, 000, '92, 2205.

Total ..... 289, 285

List of appropriations, '92, 2205.

**Contracts.**

1890. C. H. Starke, for dredging, at 25 cents per cubic yard, '90, 2357.

1891. S. O. Dixon, for dredging, at 19½ cents per cubic yard, '91, 2563.

H. Truman and G. Cooper, for 200 linear feet of pier extension, at \$13,219.20, '91, 2564.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 244; '89, 282, 286; '90, 255; '91, 326; '92, 312.

ENGINEERS IN CHARGE.

Capt. W. L. Marshall, 1884-'89. Report, '88, 1865.

Maj. C. E. L. B. Davis, 1889-'92. Reports, '89, 2076, 2108; '90, 2356; '91, 2562.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2204.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1865.

1888-'89. 36,356 cubic yards material dredged, '89, 2076.

1889-'90. 9,627 cubic yards material dredged, '90, 2357.

1890-'91. 4,089 cubic yards material dredged from channel between the piers; extension of south pier in progress, '91, 2563.

1891-'92. 10,194 cubic yards material dredged; south pier extension completed and superstructure built thereon, '92, 2205.

**Projects.**

The original project of 1843 proposed the formation of an entrance by the extension of two piers from the mouth of the river, with dredging between the piers, so as to give a channel 12 feet deep. (S. Doc. 42, 35th Cong., 1st sess., p. 62.) The modifications of this project have been to secure increased channel depths up to 16 feet, '66, i, 17; iv, 121; '67, 22; '72, 127; '77, 102, 187.

The total amount appropriated from 1844 to 1886, inclusive, has been \$237,285.

The estimated amount required for completion of project, \$25,000, '86, 303; '87, 2071.

In 1889 Maj. Davis proposed the extension of the north pier 300 feet, and the south pier 500 feet, in order to prevent the deposition of sand at the harbor entrance; estimated cost, \$66,550, which, together with the \$15,450 required for completion of the prior project, made a total of \$82,000 for completion of projects for improvement of the harbor, '89, 2077; '92, 2204.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Davis, '89, 2108.

**RAHWAY RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 430.)

**Appropriations.**

1879-'82 ..... \$37, 000

List of appropriations, '92, 881.

**Commerce.**

Decrease in, since suspension of work of improvement, '88, 650.

Reduction in freight rates consequent upon improvement, '89, 828.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 70; '89, 89; '90, 80; '91, 101; '92, 104.

ENGINEERS IN CHARGE.

Capt. G. McC. Derby, 1886-'89. Report, '88, 649.

Capt. T. L. Casey, 1889-'—. Reports, '89, 828; '90, 853; '91, 995; '92, 880.

**Operations.**

1887-'90. No operations, '88, 649; '89, 828; '90, 853; '91, 995; '92, 880.

**RAHWAY RIVER, N. J.—Continued.****Projects.**

By Col. Macomb, 1878, for the formation of a channel 8 feet deep at mean high water, and 125 feet wide from Bricktown to Main Street Bridge in Rahway; estimated cost, \$37,000, '74, 485; '80, 87. Increased in 1882 on account of extra cost for dredging to \$66,250, '82, 696; '87, 769; '91, 995.

**RANCOCAS RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 431.)

**Appropriations.**

1881-'82 .....	\$20,000
1890 .....	10,000, '91, 1085.
1892 .....	5,000, '92, 936.

Total .....	35,000
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List of appropriations, '92, 936.

**Contracts.**

1891. F. C. Somers, for dredging, at 22 cents per cubic yard, and removal of three wrecks, at a total of \$800, '91, 1085.

1892. F. C. Somers, for dredging, at 14½ cents per cubic yard, '92, 935.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 82; '91, 116; '92, 117.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1885-'91. Report, '88, 708.

Maj. C. W. Raymond, 1891-'—. Reports, '91, 1084; '92, 935.

**Operations.**

1887-'88. No operations; last appropriation made in 1882, '88, 708.

1890-'91. Three wrecks and 32,749 cubic yards of material removed from the channel between the mouth and Centerton, '91, 1085.

1891-'92. 7,330 cubic yards material dredged, '92, 935.

**Projects.**

By Col. Macomb, 1881, for excavation of a channel from 150 to 200 feet wide, with a low-water depth of 6 feet from mouth to Centerton, a distance of 7½ miles, and a 5-foot low-water channel from thence to Mount Holly; estimated cost, \$81,236, '81, 798; '91, 1084.

**RAPPAHANNOCK RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 432.)

**Appropriations.**

1852-'87 .....	\$190,500
1888 .....	* 15,000, '88, 823.
1890 .....	15,000, '90, 1069.
1892 .....	20,000, '92, 1054.

Total .....	240,500
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List of appropriations, '88, 822; '92, 1054.

**Contracts.**

1888. American Dredging Company, for dredging, at 23 cents per cubic yard, '88, 821.

1889. George E. Ward, for brush mattress dike construction, at \$4.53, \$3.45, and \$2.65, respectively, per linear foot, '89, 1006.

1891. F. C. Somers, for dredging, at 31 cents per cubic yard, '92, 1053; H. T. Morrison & Co., for construction of plant, at a total of \$6,129.75, '92, 1053.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 111; '89, 128; '90, 114; '91, 142; '92, 143.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1875-'91. Reports, '88, 819; '89, 1005; '90, 1065.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1264.

Maj. C. E. L. B. Davis, 1892-'—. Report, '92, 1050.

\*\$2,000 of this was for Urbana Creek, '90, 1068.

**RAPPAHANNOCK RIVER, VA.—Continued.****Operations.**

- 1887-'88. 730 linear feet of crib dike, and 678 linear feet of pile dike built, and 1,596 linear feet of brush mattress sunk; 12,438 cubic yards material dredged; 197 cubic yards of stone blasted and removed, '88, 822.
- 1888-'89. Repairs to plant; 758 linear feet brush bank protection repaired; 617 linear feet sheet pile dike repaired; 1,840 square feet of mattress sunk; 133 snags, logs, and trees removed; the above work was done by hired labor; 450 linear feet dike built under contract, '89, 106.
- 1889-'90. 156 linear feet of retaining dike, 462 linear feet shore connection, and 1,291 linear feet brush mattress dike built, '90, 1066.
- 1890-'91. Repairs to dike construction at Fredericksburg, Pollock, Bernard, Spottswood, and Castle Ferry bars, '91, 1266.
- 1891-'92. 18,028 cubic yards material dredged; sunken scow removed from the channel, '92, 1053.

**Physical Characteristics.**

Original condition of the river, '88, 819-820.

**Projects.**

- By Maj. Craighill, 1871, for the formation of a channel 100 feet wide and 10 feet deep at low water by dredging through shoals, removal of rocks, and by training dikes at various points, '71, 596; '72, 689.
- By S. T. Abert, 1879, for the formation of a channel 100 feet wide and 10 feet deep over the bars between Fredericksburg and Port Royal, to be secured by dredging and the construction of dikes and wing dams; also for increasing the channel width to 200 feet and the depth to 15 feet below Port Royal, and the maintenance of same by construction of training dikes; estimated cost, \$291,000, '79, 85, 613; '80, 764; '87, 935. Amount appropriated from 1871 to 1886, inclusive, \$187,500; amount estimated to complete project, \$194,000; '86, 142; '87, 937; '91, 1265.

**Surveys.****MAPS.**

'88, 822; '90, 1066.

**BARITAN BAY, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 433.)

**Appropriations.**

1881-'87 .....	\$157,500
1888 .....	25,000, '88, 636.
1890 .....	40,000, '90, 756.
1892 .....	40,000, '92, 836.

Total ..... 262,500

List of appropriations, '88, 636.

**Contracts.**

1888. Atlantic Dredging Company, for dredging, at 23½ cents per cubic yard, '88, 637.
1889. J. A. Simmons, for dredging, at 18½ cents per cubic yard, '89, 796.
1891. T. Potter, for dredging, at 16½ cents and 18½ cents per cubic yard, '91, 934.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 67; '89, 81; '90, 72; '91, 92; '92, 96.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. McFarland, 1886-'89. Report, '88, 633.

Lieut. Col. G. L. Gillespie, 1889-'— Reports, '89, 794; '90, 753; '91, 931; '92, 833.

**Obstructions.**

Illegal dumping of material, '88, 636.

**Operations.**

- 1887-'88. 163,756 cubic yards material dredged, '88, 635.
- 1888-'89. No operations, '89, 796.
- 1889-'90. 200,000 cubic yards of material dredged, '90, 755.
- 1890-'91. 82,035 cubic yards of material dredged, '91, 934.
- 1891-'92. 114,290 cubic yards of material dredged, '92, 836.

**Physical Characteristics.**

Description of the bay, '88, 633.

**RARITAN BAY, N. J.—Continued.****Projects.**

By Lieut. Col. Michler, 1880, for improvement of Raritan Bay by excavation of a channel 300 feet wide and 21 feet deep at mean low water through the shoal off Seguin Point; estimated cost, \$126,500, '81, 715, 717; '87, 750.

By Lieut. Col. Gillespie, 1884-'85, for the excavation of a channel 300 feet wide and 21 feet deep from Great Beds Light to wharves at Perth Amboy, and a 15-foot channel from outside of Great Beds Light to South Amboy; estimated cost, \$114,000, '84, 753; '85, 758; '87, 751.

Revised project in 1889, by Lieut. Col. Gillespie, for a channel 300 feet wide and 21 feet deep, mean low water, from New York Lower Bay to Perth Amboy; also a channel 300 feet wide and 15 feet deep from Great Beds Light to South Amboy; estimated cost, \$175,375, '91, 932, 933.

**Surveys.****MAPS.**

'92, Atlas, 5, 6.

**RARITAN RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 433.)

**Appropriations.**

1836-'87 .....	\$485, 213
1888 .....	50, 000, '88, 655.
1890 .....	50, 000, '90, 858.
1892 .....	40, 000, '92, 884.

Total .....

625, 213

List of appropriations, '92, 884.

**Commerce.**

Exports and imports of the region, '88, 656.

**Contracts.**

1888. M. H. Flannery, for dredging, at 40 cents per cubic yard, '88, 653.

1889. M. H. Flannery, for dredging, at 15 cents per cubic yard, '89, 830. J. D.

Leary, for construction of three dump scows, at \$5,490 per scow, '89, 833.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 71; '89, 90; '90, 81; '91, 102; '92, 104.

**ENGINEERS IN CHARGE.**

Capt. G. McC. Derby, 1886-'89. Report, '88, 652.

Capt. T. L. Casey, 1889-'—. Reports, '89, 829; '90, 855; '91, 996; '92, 881.

**ASSISTANT.**

C. S. Kelsey. Report, '92, 884.

**Operations.**

1887-'88. 7,630 cubic yards material dredged; repairs to launch and drill scow, '88, 654.

1888-'89. 29,376 cubic yards material dredged; 840 cubic yards riprap used in revetting face and top of Dike C, '89, 830.

1889-'90. 20,569 cubic yards material dredged, '90, 856.

1890-'91. 62,934 cubic yards of sand and gravel and 7,206 cubic yards rock removed, '91, 997.

1891-'92. 6,209 cubic yards of sand and gravel and 6,475 cubic yards of rock removed, '92, 883.

**Physical Characteristics.**

Description of the river, '88, 652.

**Projects.**

By Lieut. Col. Newton, 1874, for permanent improvement of the river by excavation of a 10-foot mean low water channel 200 feet wide from the mouth to New Brunswick, a distance of 12½ miles, and excavation of a tidal basin above New Brunswick locks by dredging, rock removal, and diking; estimated cost, \$2,093,662, '74, ii, 179; '82, 675; '86, 770.

Modified in 1881, without any increase in cost, to provide for dredging south channel also as to form a channel 10 feet wide and 5½ feet deep at mean low water, '87, 771; '92, 882.

**REDONDO BEACH HARBOR, CAL.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 393.

ENGINEER IN CHARGE.

Lieut. Col. W. H. H. Benyaurd, 1890. Report, '91, 2972.

**Physical Characteristics.**

Description of the locality, '91, 2972.

**Plans.**

In 1891 Lieut. Col. Benyaurd did not consider the locality worthy of improvement, '91, 2972.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Benyaurd, '91, 2972.

**RED FISH BAR, TEX.—(See GALVESTON BAY SHIP CHANNEL.)****RED RIVER (LITTLE), ARK.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 435.)

**Appropriations.**

1886-'87 .....	\$3,000
1888.....	5,400, '88, 1378.
Total .....	8,400

**Commerce.**

Prospective advantages to commerce to arise from improvement, '91, 2054; '92, 1688.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 185; '89, 217; '90, 196; '91, 254; '92, 245.

ENGINEER IN CHARGE.

Capt. H. S. Taber, 1885-'—. Reports, '88, 1377; '89, 1641; '90, 1927; '91, 2053; '92, 1687.

**Operations.**

1887-'88. No operations, '88, 1377.

1888-'89. Dredge and 2 material barges built, '89, 1642.

1889-'90. 495 tons of rock removed from Bess Shoals below Judsonia, '90, 1927.

1890-'91. 3,331 trees and 100 cords of brush cleared from the channel and banks, '91, 2054.

1891-'92. 11,794 overhanging trees and 146 cords of brush cleared from the banks, and 100 tons of rock removed from Bess Shoals, '92, 1688.

**Projects.**

By Capt. Taber, 1884, for improvement of three shoals above Judsonia by the removal of obstructing bowlders and cutting a channel 3 feet deep through the shoals below Judsonia; estimated cost, \$8,400, '85, 1612, 1616; '87, 1504. Increased in 1890 to \$11,400, '90, 1927.

**BED RIVER, LA., ARK., AND TEX.—IMPROVEMENT OF, EXCEPT AT MOUTH.**

(Continued from Vol. II, p. 436.)

**Appropriations.**

1828-'87 .....	\$1,532, 137.50
1888.....	55,000.00, '88, 1342.
	* 3,000.00, '88, 1376.
	† 35,000.00, '88, 177.
1890.....	100,000.00, '90, 1849.
	* 2,000.00, '90, 1927.
	† 28,000.00
1892.....	145,000.00, '92, 1597.
	* 3,500.00, '92, 1601.

Total .....

1,903,637.50

List of appropriations, '88, 1342; '92, 1574.

\* Red River above Fulton.

† Survey from Fulton to the Atchafalaya River.

**RED RIVER, LA., ARK., AND TEX.—Continued****Commerce.**

Benefits to be derived from completion of improvement on the river above Fulton, '89, 1640.

Steamers engaged in navigation, '92, 1598.

**Contracts.**

1891. Martin & Hunt, for closing outlets, at a total of \$4,930, '92, 1591.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 176, 184; '89, 207, 217; '90, 186, 195; '91, 236, 237; '92, 229, 230.

**ENGINEERS IN CHARGE.**

Capt. J. H. Willard, 1886-'—. Reports, '88, 1331; '89, 1584; '90, 1819, 1833; '91, 1946, 1961; '92, 1573, 1600.

Capt. H. S. Taber, \* 1884-'—. Reports, '88, 1375; '89, 1639; '90, 1925.

**ASSISTANTS.**

H. Vance. Report, '88, 1339.

J. Ewens. Reports, '91, 1953; '92, 1592.

H. M. Marshall. Report, '92, 1595.

**Operations.**

1887-'88. 798 snags and 10 drift piles removed from the river above Fulton, '88, 1375. 4,400 snags and stumps, 110 log jams, and 2 wrecks removed at and below Shreveport, '88, 1333-1335.

1888-'89. 2,900 logs, snags, and stumps and 160 log jams removed from the river, and 7,000 trees cut from the banks at and below Fulton, below Shreveport, and at Cypress and Dorcheat bayous, '89, 1585-1587. 764 snags removed above Fulton, '89, 1640.

1889-'90. No operations above Fulton, '90, 1926. 48,959 cubic yards earth and 4,400 snags removed from the channel; 16,850 trees cut from the banks, and 231,710 square yards brush and willows cut at Alexandria, and at Cypress and Dorcheat bayous, '90, 1827, 1828.

1890-'91. 6,038 snags cleared from the channel; 134 jams removed; 1,022 leaning trees cut; 2 wrecks removed; 109,200 square yards of brush cleared from the banks, '91, 1949, 1950. 956 snags and 111 leaning trees removed above Fulton, '91, 1961, 1962.

1891-'92. 7,981 cubic yards material dredged; 5 wrecks and 11,899 snags removed from the channel, and 8,846 trees and 107,325 square yards of brush cleared from the banks, '92, 1580, 1582. Sale and Murphy outlets closed by dam construction under contract, '92, 1592. No operations above Fulton, '92, 1601.

**Projects.**

From 1828 to 1852, inclusive, \$533,137.50 was appropriated for the removal of the raft. Between 1852 and 1872 no further appropriations were made.

In 1872, under a renewal of appropriations, the present project for the removal of the raft and the closing of Tones Bayou by a dam was adopted, '72, 569; '73, 624, 628, 674.

In 1875 it was proposed to protect the city front at Alexandria from erosion by means of stone revetment, '75, i, 906.

In 1878 the improvement of the river below Fulton, Ark., by the removal of snags and other obstructions, was inaugurated, '78, 634.

In 1879 the improvement of the Falls near Alexandria was undertaken, so as to furnish a channel 75 feet wide and 4½ feet deep, '80, 1348.

In 1882 it was proposed to close certain outlets above Shreveport, '82, 1546; '85, 1477.

In 1884 the improvement of the river above Fulton, Ark., by the removal of snags and similar obstructions, was undertaken, '85, 1618, 1622. The amount appropriated for these projects from 1872 to 1886, inclusive, was \$809,000, '87, 1451; '92, 1574.

**Surveys.**

Of the Red River from Fulton, Ark., to the Atchafalaya River ordered by act of August 5, 1886. In progress under direction of Capt. Willard, '88, 177, 1337; '89, 1591; '90, 1830, 1838.

**MAPS.**

'90, 1840, 1870; '91, 1955; '92, Atlas, 82.

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\* Red River above Fulton.



**RED RIVER OF THE NORTH, and tributaries above Fergus Falls and Crookston, Minn., and Big Stone Lake, Minn. and S. Dak.—SURVEY OF.**

**Commerce.**

Commercial interests of the locality, '92, 1862.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 274; '92, 262, 1853.

ENGINEERS IN CHARGE.

Maj. W. A. Jones, 1892. Report, '92, 1853, 1863.

Col. O. M. Poe, 1892. Report, '92, 1862.

**Physical Characteristics.**

Description of the locality, '92, 1855.

Description of the Red River of the North, with tributaries, and Big Stone Lake and Lake Traverse, '92, 1855.

**Plans.**

By Maj. Jones, 1892, for the formation of two reservoir systems at Red Lake and Lake Traverse, at the headwaters of tributaries to the Red River of the North, for the purpose of diminishing the effects of floods and of storing water for use at low stages in the Red River system; estimated cost, \$860,000, '92, 1872.

In 1892 the Chief of Engineers did not consider the river worthy of improvement to this extent, '92, 1854.

**Surveys.**

Ordered by act of September 19, 1890. Made, 1892, under direction of Maj. Jones, '92, 1863.

**RED RIVER OF THE NORTH, MINN. AND DAK.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 439.)

**Appropriations.**

1876-87 .....	\$123,000
1888 .....	20,000, '88, 1555.
1890 .....	25,000, '90, 2096.
1892 .....	25,000, '92, 1845.

Total ..... 193,000

List of appropriations, '91, 2212.

**Commerce.**

Comparative statement of freight moved by steamboats from 1879 to 1891, '92, 1849.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 204, 206; '89, 239; '90, 214; '91, 272; '92, 261.

ENGINEERS IN CHARGE.

Maj. C. J. Allen, 1879-'90. Reports, '88, 1552, 1584, 1586; '89, 1806.

Maj. W. A. Jones, 1890-'—. Reports, '90, 2093; '91, 2210; '92, 1843.

ASSISTANT.

R. Davenport. Reports, '88, 1553, 1585; '90, 2096; '91, 2212; '92, 1845, 1847.

**Operations.**

1887-'88. 26,886 cubic yards material dredged; 618 linear feet wing dams built; 9 trees and 30 cubic yards rock removed from the channel, '88, 1552.

1888-'89. 40,767 cubic yards material dredged; 7,798 linear feet wing dams built, '89, 1807.

1889-'90. 36,908 cubic yards material dredged; 1,450 linear feet wing dams built; 8,125 linear feet training dams built, '90, 2094.

1890-'91. 44,535 cubic yards material dredged, and 9,525 linear feet of wing and training dams built, '91, 2211.

1891-'92. 100,442 cubic yards material dredged, and 23,695 linear feet of wing dams and training walls built, '92, 1844.

**Plans.**

By Maj. Allen, 1887, for improvement of the river between Moorhead and Fergus Falls by construction of contraction works and removal of snags, bowlders, and leaning trees; estimated cost, \$22,663.98, '88, 1587.

**RED RIVER OF THE NORTH, MINN. AND DAK.**—Continued.**Projects.**

By Maj. Farquhar, 1878, for improvement of the river between Breckenridge and the northern boundary line by dredging through bars and removal of snags, logs, bowlders, and similar obstructions; estimated cost, \$145,310, '79, 1191; '81, 1757. Revised to \$179,310 in 1883, '83, 1450; '87, 1712.

In 1887 the cost of completing the improvement was estimated at \$79,598.37, '88, 204; '91, 2210.

**Surveys.**

Of river between Moorhead and Fergus Falls ordered by act of August 5, 1886. Made, 1887, under direction of Maj. Allen, '88, 1586.

**RED RIVER OF THE NORTH, MINN. AND DAK.**—CONSTRUCTION OF LOCK AND DAM AT GOOSE RAPIDS.

(Continued from Vol. II, p. 439.)

**Appropriations.**

1881-'87 ..... \$50,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 274.

ENGINEERS IN CHARGE.

Maj. C. J. Allen, 1881. Report, '88, 1555.

Maj. W. A. Jones, 1891. Report, '91, 2220.

**Operations.**

1887-'88. No operations, '88, 1555.

**Plans.**

By Maj. Allen, 1879, for construction of lock and dam at Goose Rapids having a lift of 12 feet; estimated cost, \$219,288, '79, 1191; '81, 1760; '87, 1721.

In 1884 revised plans and estimates were submitted, '84, 1613; '87, 1722.

The total amount appropriated up to 1887 being considered too small to warrant the commencement of operations, appropriations were transferred, in 1887, to the general improvement of the Red River, '87, 1722.

After a reexamination in 1891 Maj. Jones reported that the Red River of the North was not worthy of a slack-water improvement at Goose Rapids, '91, 2221.

**REDWOOD HARBOR, CAL.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 441.)

**Appropriations.**

1884-'87 ..... \$8,000

1888 ..... 7,400, '88, 2108.

1890 ..... 8,000, '90, 2954.

Total ..... 23,400

List of appropriations, '92, 2623.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 291; '89, 345; '90, 311; '91, 390, 393, 2966; '92, 367.

ENGINEERS IN CHARGE.

Col. G. H. Mendell, 1882-'89. Report, '88, 2108.

Lieut. Col. W. H. H. Benyaurd, 1889-'— Reports, '89, 2472; '90, 2897; '91, 2953, 2966; '92, 2623.

**Operations**

1887-'88. 10,000 cubic yards material dredged, '88, 2108.

1888-'89. 36,000 cubic yards material dredged, '89, 2472.

1889-'90. 16,600 cubic yards material dredged, '90, 2898.

1890-'91. No operations, '91, 2954.

1891-'92. 40,845 cubic yards material dredged, '92, 2623.

**REDWOOD HARBOR, CAL.—Continued.****Plans.**

In 1890 Lieut. Col. Benyaurd did not consider that the straightening of the creek, the improvement desired, would be warranted by the interests of navigation, '91, 2967.

**Projects.**

By Col. Mendell, 1882, for improvement of the harbor by excavation of a channel from the city of Redwood to San Francisco Bay, a distance of 1 mile, giving a high-water depth of 7 feet; estimated cost, \$15,000, '84, 2244.

**Surveys.**

Examination of Redwood Creek ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Benyaurd, '91, 2966.

**RESERVOIRS AT SOURCES OF THE MISSISSIPPI.—(See MISSISSIPPI RIVER, RESERVOIRS AT SOURCES OF.)****RIO GRANDE RIVER, NEW MEX.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 1571.

**ENGINEER IN CHARGE.**

Maj. O. H. Ernst, 1888. Report, '89, 1571.

**ASSISTANT.**

G. Bagnall. Report, '89, 1572.

**Physical Characteristics.**

Description of the locality, '89, 1571.

**Plans.**

In 1889 Maj. Ernst did not consider an improvement of the river desirable as it would involve an expenditure far beyond the commercial interests involved, '89, 1572.

**Surveys.**

Examination from Embudo to El Paso ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Ernst, '89, 1571.

**ROANOKE RIVER, VA. AND N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 443.)

**Appropriations.**

1871-'87 .....	\$73, 000
1888 .....	40, 000, '88, 843.
1890 .....	25, 000, '90, 1109.
1892 .....	50, 000, '92, 1107.

Total ..... 188, 000

List of appropriations, '88, 842; '92, 1109.

**Commerce.**

Development of, consequent upon improvement, '89, 1040.

Above Weldon, '90, 1178.

Freight transportation upon the Roanoke from 1871 to 1891, '92, 1110.

List of steamers navigating the river, '92, 1110.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 115; '89, 135, 149; '90, 121, 133; '91, 154; '92, 155.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1874-'89. Report, '88, 840.

Capt. W. H. Bixby, 1889-'92. Reports, '89, 1040, 1175; '90, 1106; '91, 1330.

Maj. W. S. Stanton, 1892-'— . Report, '92, 1103.

**ASSISTANTS.**

Charles Schuster. Reports, '89, 1042; '90, 1110; '91, 1333; '92, 1108.

E. D. Thompson. Report, '90, 1109.

**ROANOKE RIVER, VA. AND N. C.—Continued.****Operations.**

- 1887-'88. 2,272 logs, snags, and stumps and 2,911 overhanging trees removed, '88, 841.  
 1888-'89. 1,200 logs, snags, and stumps and 153 small snags removed from the channel, and 1,652 trees pulled back on the banks, '89, 1041.  
 1889-'90. 26,948 cubic yards mud, gravel, and bowlders removed; 5,500 trees, stumps, and snags removed from the banks, '90, 1108.  
 1890-'91. 6,531 snags and stumps and 110 cords of small snags removed from the channel, and 2,939 trees cleared from the banks, '91, 1332.  
 1891-'92. 5,530 snags, 606 stumps, and 199 cords of small snags cleared from the channel, '92, 1108.

**Physical Characteristics.**

Description of the river, '90, 1176.

**Projects.**

By Maj. Craighill, 1872, for improvement of the river by removal of wrecks, snags, and dangerous rocks, and the contraction of the channel way by jetties so as to give throughout the year an unobstructed 10-foot navigation from Albemarle Sound up to Hamilton, and 5-foot navigation up to Weldon; estimated cost, \$269,000, '89, 1040; '91, 1331.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '90, 1176.

**MAPS.**

'88, 842; '90, 1110; '92, Atlas, 18.

**ROCK ISLAND HARBOR, ILL.—(See MISSISSIPPI RIVER FROM SAINT PAUL TO DES MOINES RAPIDS.)****ROCKLAND HARBOR, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 445.)

**Appropriations.**

1880-'87 .....	\$122,500
1888.....	30,000, '88, 385.
1890.....	37,500, '90, 438.
1892.....	30,000, '92, 512.
Total .....	220,000

List of appropriations, '88, 384; '89, 526.

**Contracts.**

1889. J. F. Hamilton, for furnishing and placing stone upon the breakwater, at 93½ cents per ton of 2,000 pounds, '89, 526.  
 1890. W. S. White, for furnishing stone, at 78½ cents per ton, and taking up and relaying breakwater stone, at 98½ cents per ton, '91, 589.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 15; '89, 24; '90, 20; '91, 25; '92, 29.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'—. Reports, '88, 384; '89, 525; '90, 438, 439; '91, 589.  
 Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 511.

**Operations.**

- 1887-'88. 17,823 tons stone delivered upon breakwater, '88, 384.  
 1888-'89. 13,599 tons stone delivered upon the breakwater, '89, 525.  
 1889-'90. 16,474 tons stone delivered upon the breakwater, '90, 438.  
 1890-'91. 2,762 tons stone delivered upon the breakwater, '91, 589.  
 1891-'92. 23,500 tons of stone deposited in the breakwater, '92, 512.

**Projects.**

By Col. Thom, 1880, modified by Board of Engineers, for improvement of harbor by construction of two breakwaters to a height of 5 feet above mean low water, with a width on top of 10 feet, one extending from Jameson Point 1,900 feet southeast and the other extending from South Ledge 2,640 feet toward Jameson Point; estimated cost, \$550,000, '81, 471, 473; '82, 492; '86, 536.

**ROCKLAND HARBOR, ME.—Continued.****Projects—Continued.**

Revised in 1887 to bring top of breakwaters to plane of high water; estimated cost, \$650,000, '87, 447.

Modified in 1890 to increase top width of the Jameson Point Breakwater to 20 feet, '90, 20, 438.

In 1890 Lieut. Col. Smith proposed a modification of the project, omitting the inner breakwater at South Ledge and extending the present breakwater from Jameson Point 2,280 feet on a continuation of its present alignment, involving the deposition of 480,000 tons of stone, at an estimated cost of \$1,480,000, '90, 440. Approved by Board of Engineers, '90, 441. (Cols. Abbot and Comstock and Lieut. Col. Gillespie.)

**Surveys.**

MAPS.

'90, 440.

**ROCKPORT HARBOR, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 445.)

**Appropriations.**

1888..... \$10,000, '89, 524.

1890..... 5,000, '90, 437.

Total ..... 15,000

**Commerce.**

Amount of Rockport shipments and probable increase of same consequent upon improvement, '88, 408.

**Contracts.**

1889. E. P. Lovering, for dredging, at 20 cents per cubic yard, '89, 525.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 15, 22; '89, 24; '90, 19; '91, 25; '92, 29.

ENGINEERS IN CHARGE.

Lieut. Col. J. A. Smith, 1888-'92. Reports, '88, 407, 409; '89, 524; '90, 437; '91, 588.

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 510.

ASSISTANT.

F. S. Burrowes. Report, '88, 410.

**Operations.**

1887-'89. No operations, '88, 407; '89, 524.

1889-'90. 45,000 cubic yards material dredged, '90, 437.

1890-'91. No operations, '91, 588.

1891-'92. 15,000 cubic yards material dredged, '92, 511.

**Physical Characteristics.**

Situation of the harbor, '88, 407.

**Projects.**

By Lieut. Col. Smith, 1888, for improvement of the harbor, increasing the depth to 12 feet at the upper end by dredging; estimated cost, \$14,000, '88, 410; '92, 510.

**ROCK HALL HARBOR, MD.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 132; '92, 132.

ENGINEER IN CHARGE.

Mr. W. F. Smith, U. S. agent, 1890. Report, '92, 999, 1001.

ASSISTANT.

A. Stierle. Report, '92, 999, 1002.

**Physical Characteristics.**

Description of the locality, '92, 1002.

**Plans.**

By W. F. Smith, 1891, for excavation of a 10-foot low-water channel 100 feet wide from the channel in Swan Creek Inlet to the old pier in the harbor; estimated cost, \$9,513, '92, 1001.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Mr. W. F. Smith, '92, 1001.

**ROCKY RIVER HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 446.)

**Appropriations.**

1872-'80 ..... \$39, 000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 273.

ENGINEER IN CHARGE.

Maj. L. C. Overman, 1883-'88. Report, '88, 2001.

**Operations.**

1887-'88. No operations, '88, 2001.

**Plans.**

Maj. Overman, 1888, reports existing improvements are meeting all the requirements of commerce, and recommends no further appropriations, '88, 2001.

**Projects.**

The project of 1871 proposed the formation of a channel of entrance from Lake Erie 100 feet wide and from 6 to 12 feet deep by the construction of an east pier, and dredging, '71, 212; '80, 2133; '81, 2310.

No further appropriation asked for, '80, 2134.

**ROMERLY MARSH, GA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 446.)

**Appropriations.**

1882-'87 ..... \$37, 475. 00

1888 ..... 4, 633. 77, '88, 1035.

Total ..... 42, 108. 77

List of appropriations, '88, 1035.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 140; '89, 160; '90, 143.

ENGINEER IN CHARGE.

Lieut. O. M. Carter, 1888-'— . Reports, '88, 1033; '89, 1243; '90, 1367.

**Operations.**

1887-'90. No operations, '88, 1034; '89, 1244; '90, 1368.

**Projects.**

By Col. Gillmore, 1880, for connection of Romerly Marsh Creek with Warsaw Sound by excavation of a canal 1,156 yards long, with a low-water channel of 48 feet width by 7 feet depth; estimated cost, \$38,720, '81, 1160, 1161.

**RONDOUT HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 447.)

**Appropriations.**

1872-'87 ..... \$95, 500

1888 ..... 5, 000, '88, 597.

1890 ..... 5, 000, '90, 704.

1892 ..... 5, 000, '92, 775.

Total ..... 110, 500

List of appropriations, '89, 766; '92, 775.

**Commerce.**

Reduction in freight and towing rates since harbor improvement, '89, 766.

**Contracts.**

1888. J. L. Powley, for piles, timber, iron, and stone, '88, 598.

1890. F. J. Kelly, for dike repair, '90, 705.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 58; '89, 73; '90, 64; '91, 83; '92, 87.

ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1885-'89. Report, '88, 596.

Lieut. Col. G. L. Gillespie, 1889-'— . Reports, '89, 764; '90, 701; '91, 882; '92, 773.

**RONDOUT HARBOR, N. Y.—Continued.****Operations.**

1887-'88. Repairs to dikes and protection of same by fender piling, '88, 597.

1888-'89. No operations, '89, 765.

1889-'90. Piers repaired under contract, '90, 703.

1890-'91. No operations, '91, 883.

1891-'92. Repairs under contract to north and branch dikes, '92, 774.

**Physical Characteristics.**

Description of the harbor, '88, 596.

**Projects.**

By Lieut. Col. Newton, 1871, for the formation of a channel in prolongation of Rondout Creek, with a mean low-water depth of from 10 to 13½ feet and a width of from 100 to 200 feet, by dredging and the construction of parallel dikes and branch dikes; estimated cost, \$172,500, '72, 811, 812; '80, 495. Project completed in 1880 at a cost of \$90,000, '86, 671.

By Capt. Mercur, 1884, for widening the outlet between the dikes, \$10,000, '84, 700. Estimate for repair of piers in 1888, \$10,000, '88, 597. Increased in 1889 to \$25,000, '89, 765; '92, 773.

**ROUGE RIVER, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 448.)

**Appropriations.**

1888.....	\$10,000, '88, 268.
1890.....	{ 10,000, '90, 2749.
	{ * 5,000
1892.....	11,690, '92, 2480.

Total ..... 36,690

**Contracts.**

1888. J. Rooney, for dredging, at 11½ cents per cubic yard, '89, 2274.

1890. J. B. & G. H. Breyman, for dredging, at 10½ cents per cubic yard, '91, 2792.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 268; '89, 318; '90, 288; '91, 360, 363; '92, 343.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1886-'— Reports, '89, 2274; '90, 2747; '91, 2791, 2822; '92, 2480.

**Operations.**

1887-'88. 28,792 cubic yards material dredged, '89, 2274.

1888-'89. 52,371 cubic yards material dredged, '89, 2275.

1889-'90. No operations, '90, 2748.

1890-'91. 90,189 cubic yards material dredged, '91, 2791.

1891-'92. No operations, '92, 2480.

**Plans.**

By Col. Poe, 1890, for the excavation of a turning basin 500 feet long and 250 feet wide about 2 miles above the junction of the Rouge with the Detroit River, at an estimated cost of \$15,611, '91, 2823.

**Projects.**

By Col. Poe, 1886, for the formation of a dredged channel from 240 to 100 feet wide and 16 feet deep, from the river's mouth to the bridge of the Saint Louis and Wabash Railroad; estimated cost, \$31,690, '87, 2278.

**ROUGH RIVER, KY.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 448.)

**Appropriations.**

1890.....	\$25,000, '91, 2448.
1892.....	15,000, '92, 2082.

Total ..... 40,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 305; '92, 291.

\* Site for turning basin.

**ROUGH RIVER, KY.—Continued.****Engineers—Continued.****ENGINEER IN CHARGE.**

Maj. D. W. Lockwood, 1890-'—. Reports, '91, 2446; '92, 2081.

**ASSISTANT.**

Lient. W. L. Sibert. Report, '92, 2082.

**Operations.**

1890-'91. 1,969 trees cleared from the banks and 290 logs removed from the channel, '91, 2448.

1891-'92. 29,499 trees deadened, 8,807 trees cut upon the banks and in the river, and 5,637 snags and 8 cubic yards of stone removed from the channel, '91, 2082.

**Projects.**

By Maj. Lockwood, 1890, for improvement of the river by construction of a lock and dam, at a cost of \$96,556, and removal of snags and similar obstructions between Hartford, Ky., and the mouth, at a cost of \$9,000; total cost of improvement, \$105,556, '91, 2448.

**ROUSES POINT HARBOR, N. Y.—CONSTRUCTION OF BREAKWATER AT**

(Continued from Vol. II, p. 448.)

**Appropriations.**

1884-'87 .....	\$55,000
1888.....	13,500, '88, 2094.
1890.....	15,000, '90, 2876.
1892.....	15,000, '92, 2604.

Total ..... 98,500

**Contracts.**

1889. W. Johnston, for breakwater extension, '89, 2443.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 448; '89, 339; '90, 306; '91, 384; '92, 363.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1885-'—. Reports, '88, 2093; '89, 2443; '90, 2875; '91, 2927; '92, 2604.

**Operations.**

1887-'88. 65 linear feet of breakwater completed, '88, 2093.

1888-'89. Breakwater extension continued, '89, 2443.

1889-'90. Breakwater extension continued, '90, 2875.

1890-'91. Breakwater extension in progress, '91, 2927.

1891-'92. Breakwater extension in progress, '92, 2604.

**Projects.**

By Board of Engineers, 1885, for a breakwater of random stone about 2,000 feet long, extending from Stony Point toward Windmill Point until the 18-foot curve in the lake is reached; estimated cost, \$110,000, '85, 2303. Project approved by the Secretary of War, '85, 2304; '92, 2604.

**SABINE PASS, TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 449.)

**Appropriations.**

1882-'87 .....	\$866,750
1888.....	250,000, '88, 1263.
1890.....	300,000, '90, 1757.
1892.....	350,000, '92, 1509.

Total ..... 1,766,750

List of appropriations, '92, 1509.

**Contracts.**

1888. Louisiana Jetty and Lightering Company, for jetty construction, '89, 1497.

1891. C. Clark & Co., for jetty construction, '92, 1507.



**SABINE PASS, TEX.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 172; '89, 200; '90, 181; '91, 227; '92, 221.

**BOARD OF ENGINEERS.**

Convened at New Orleans, La., February 11, 1891, by S. O. No. 89, to report upon improvement of Sabine Pass. Report, '91, 1834. (Col. Comstock, Maj. Quinn, and Capt. Black.)

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1261; '89, 1496; '90, 1753.

Maj. J. B. Quinn, 1891-'—. Reports, '91, 1831; '92, 1506.

**ASSISTANT.**

A. C. Bell. Reports, '89, 1499; '90, 1757.

**Operations.**

1887-'88. 6,993 cubic yards brush mattress and 5,767 tons stone placed in east jetty, '88, 1262.

1888-'89. East jetty foundation extended 2,300 feet, '89, 1497.

1889-'90. 7,458 cubic yards of brush, 18,876 cubic yards sandstone and granite riprap, and 9,378 tons of sandstone placed in jetty, '90, 1755.

1890-'92. Jetty construction in progress under contract, '91, 1832; '92, 1508.

**Projects.**

By Capt. C. W. Howell, 1875, for the formation, by dredging, of a channel across the bar  $2\frac{1}{2}$  miles long, 150 feet wide, and 12 feet deep, '75, i, 947. Dredging operations were in force from 1875 to 1881, during which interval about \$160,000 was expended, '81, 198.

In 1882 Capt. Heuer proposed two high brush and stone jetties, curving from either bank at mouth of Sabine River, parallel with each other and at a distance of 2,000 feet apart, the west jetty to be 18,120 feet in length, and east jetty 19,800 feet in length; also for possible excavation of channel between jetties 20 feet deep and 100 feet wide at bottom, this channel to extend from jetty entrance to 18-foot channel inside the bar; estimated cost, \$3,177,606, '82, 1436, 1437; '83, 1054.

The Board of Engineers of 1882 favored high jetties without the shore openings proposed by Maj. Heuer, '82, 1439; '91, 1831.

In 1891 the Board (Col. Comstock, Maj. Quinn, and Capt. Black) proposed the elevation of the east jetty to 2 feet above mean high water for the first 16,600 feet, and the west jetty to mean high water level for the first 4,000 feet, thence to the end of the jetty 2 feet above mean high water, '91, 1835.

**Surveys.**

Survey of the Pass made, 1888, under direction of Capt. Fisk, '89, 1499.

Survey of the Pass made, 1889, under direction of Capt. Fisk, '90, 1756, 1759.

**MAPS.**

'89, 1498; '90, 1759; '92, Atlas, 77.

**SABINE RIVER, LA. AND TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 451.)

**Appropriations.**

1872-'82 .....	\$34, 700
1892 .....	5, 000, '92, 1511.

Total .....	39, 700
List of appropriations, '92, 1511.	

**Contracts.**

1889. Sabine Tram Company, for pile and brush dam construction, at a total of \$3,647, '90, 1752.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 200; '90, 180; '91, 228, 230; '92, 222, 223.

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1259; '89, 1494; '90, 1752.

Maj. J. B. Quinn, 1891-'—. Reports, '91, 1835; '92, 1510, 1513.

**Operations.**

1887-'89. No operations, '88, 1260; '89, 1494.

1889-'90. Construction of pile and brush dams begun under contract, '90, 1752.

1890-'91. Pile and brush dam construction in progress under contract, '91, 1835.

1891-'92. Project completed, '92, 1511.

**SABINE RIVER, LA. AND TEX.—Continued.****Plans.**

Capt. Fisk reports, 1888, that further improvements are inadvisable, as the existing channel meets the requirements of commerce, '88, 1260.

By Maj. Quinn, 1891, for removal of snags and similar obstructions between Sabine Lake and Sudduths Bluff, at an estimated cost of \$10,000, '92, 1514.

**Projects.**

By Capt. Howell, 1873, for dredging a channel across the bar at the mouth of the river to a depth of 5 feet, and the removal of snags and obstructions from the river above; estimated cost, \$56,000, '73, 681; '79, 904, 905; '80, 1195.

By Maj. Mausfield, 1880, for excavation of cut-off from the main river into the Narrows 320 feet long, 40 feet wide, and 5 feet deep; for the formation of two other cut-offs of 100 feet each; removal of snags, logs, and similar obstructions, and construction of pile and brush obstruction across old channel; estimated cost, \$17,500, '80, 1199. The river not considered susceptible of permanent improvement, '86, 222; '92, 1510.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Quinn, '92, 1513.

**SACKETTS HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 452.)

**Appropriations.**

1826-'87 .....	\$13, 000
1888 .....	2, 000, '88, 2087.
Total .....	15, 000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 285; '89, 336; '90, 305; '91, 382; '92, 361.

**ENGINEERS IN CHARGE.**

Capt. C. F. Palfrey, 1887-'90. Reports, '88, 2086; '89, 2422.

Maj. M. B. Adams, 1890-'91. Report, '90, 2868.

Capt. D. C. Kingman, 1891-'—. Reports, '91, 2918; '92, 2597.

**Operations.**

1887-'88. No operations, '88, 2087.

1888-'89. 164 linear feet of stake and fascine work built, '89, 2422.

1889-'92. No operations, '90, 2868; '91, 2918; '92, 2597.

**Plans.**

In 1890 Maj. Adams reported that the present needs of the harbor were satisfied by existing works, '90, 2868.

**Projects.**

In 1826 and 1828 \$6,000 was expended in clearing wrecks from the harbor, '87, 312.

By Lieut. Col. McFarland, 1841, for improvement of the harbor by dredging the area to within 50 feet of the wharf line to 12 feet deep at low water; estimated cost, \$22,000, '82, 2490.

Modified in 1883 by a moving crib placed near end of Ship House Point, '83, 1953; '87, 2391; '92, 2597.

**SACO RIVER, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 453.)

**Appropriations.**

1884-'87 .....	\$22, 500
1888 .....	10, 000, '88, 391.
1890 .....	* 65, 000, '90, 448.
1892 .....	25, 000, '92, 523.

Total .....

List of appropriations (river and breakwater), '92, 522.

**Contracts.**

1889. G. W. Andrews, for construction of stone jetty, training wall, and bank protection, at 93 cents per ton, '90, 418.

1890. G. W. Andrews, for stone jetty construction, at 84 cents per ton, '91, 600.

\* Including breakwater at mouth of Saco River.

**SACO RIVER, ME.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 18; '89, 27; '90, 23; '91, 28; '92, 34.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'92. Reports, '88, 390; '89, 534; '90, 447; '91, 599.

Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 521.

**Operations.**

1887-'88. 16,987 cubic yards material dredged from the channel, and 19,407 cubic yards from the shoals; 214 cubic yards of rock removed, '88, 390.

1888-'89. 4,641 tons stone delivered in the training wall, '89, 535.

1889-'90. 3,185 tons stone delivered in the training wall, '90, 448.

1890-'91. 8,626 tons stone delivered in the jetty, '91, 600.

1891-'92. 26,324 tons stone delivered in the south jetty, '92, 523.

**Projects.**

By Lieut. Col. Smith, 1887, for the formation of a channel 6 feet deep at mean low water to the cities of Saco and Biddeford, by construction of a jetty at the mouth of the river, pier head and revetment along coal wharf channel, wing dams, shoal revetment, and dredging; estimated cost, \$140,000, '88, 391. Increased in 1889 to \$155,000, '89, 535.

In 1889 the improvements of Saco River and that at the mouth were combined under one project, and the revised cost for completion for both river and breakwater placed at \$185,000, '92, 522.

**SACO RIVER, ME.—BREAKWATER AT MOUTH OF.**

(Continued from Vol. II, p. 452.)

**Appropriations.**

1827-'87 .....	\$196,775
1888 .....	12,500, '88, 389.
1890 .....	(*)

Total ..... 209,275

List of appropriations, '88, 389.

**Contracts.**

1889. G. W. Andrews, for furnishing and placing stone upon the breakwater, at 87 cents per ton of 2,000 pounds, '89, 534.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 18; '89, 27; '90, 23; '91, 28.

**ENGINEER IN CHARGE.**

Lieut. Col. J. A. Smith, 1886-'—. Reports, '88, 389; '89, 533; '90, 446; '91, 598.

**Operations.**

1887-'88. 6,484 tons stone delivered upon the breakwater, '88, 389.

1888-'89. 104 tons stone placed upon the breakwater, '89, 533.

1889-'90. 10,030 tons stone placed in the breakwater, '90, 446.

1890-'91. 1,950 tons stone placed in the breakwater, '91, 599.

**Projects.**

By Col. Thom, 1883, for repairing and extending the old breakwater, giving it a height of 15 feet above low water and a top width of 12 feet; the original estimate as amended was \$70,000; amount appropriated to 1888, \$27,500; amount required for completion of existing project, \$30,000, '84, 484; '85, 471; '87, 453; '88, 18, 389.

**SACRAMENTO AND FEATHER RIVERS, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 453.)

**Appropriations.**

1875-'87 .....	\$445,000
1888 .....	20,000, '88, 2133.
1890 .....	30,000, '90, 2916.
1892 .....	150,000, '92, 2654.

Total ..... 645,000

List of appropriations, '92, 2652.

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\* Appropriation for the breakwater included in appropriation for Saco River. See '90, 477.

**SACRAMENTO AND FEATHER RIVERS, CAL.—Continued.****Commerce.**

Freight movement on the Upper and Lower Sacramento, '92, 2654.

**Contracts.**

1890. J. Simpson, for closing break in levee by pile and brush construction, at \$16,265, '90, 2915.

1891. W. Elliott, for repair of levees, at 27½ cents per cubic yard, '91, 2988.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 295; '89, 350; '90, 314; '91, 396, 399; '92, 372.

**BOARD OF ENGINEERS.**

Convened at San Francisco, February 3, 1891, by S. O. No. 66, to consider the Sacramento and Feather rivers with a view to their future improvement. Report, '91, 2990. (Col. Mendell, Maj. Mackenzie, and Capt. Kingman.)

Convened at San Francisco, February 9, 1891, by S. O. No. 56, to report upon the mining débris question in the State of California. Report, '91, 2986. (Lieut. Col. Benyard and Majs. Heuer and Handbury.)

**ENGINEER IN CHARGE.**

Maj. W. H. Heuer, 1887-'—. Reports, '88, 2132; '89, 2486; '90, 2912; '91, 2987; '92, 2652.

**Operations.**

1887-'88. 238 snags removed, and 550 linear feet wing dams built by hired labor, '88, 2132.

1888-'89. 658 snags removed by hired labor, '89, 2486.

1889-'90. Break in levee below Sacramento City closed under contract, '90, 2915.

1890-'91. 855 snags removed by hired labor; three levee breaches, aggregating 480 feet in length, repaired under contract, '91, 2988.

1891-'92. 974 snags removed, and 536 linear feet of wing dams built in the Upper Sacramento River, '92, 2652.

**Projects.**

The project of Lieut. Col. Mendell, 1874, for improvement of Sacramento and Feather rivers, proposed snag removal and wing-dam construction, continued throughout; the amount appropriated from 1880 to 1886 for this work was \$445,000. The improvement was made to include, in 1880, the Upper Sacramento for 100 miles above Colusa. The projects have for their object the temporary improvement of the low-water channel, and consist of snagging, dam construction, and bar scraping, carried on by hired labor and the United States snag boat, '75, 11, 700; '80, 2234; '86, 1926.

In 1891 the Board of Engineers proposed, for the further improvement of the Sacramento and Feather rivers, (1) a specific annual appropriation of \$25,000 for snagging, wing-dam construction, etc., above Sacramento City; (2) an appropriation of \$275,000 for removal of obstructions in the Lower Sacramento River, and \$25,000 for the closure of Jacobs Slough above Sacramento City; (3) an appropriation of \$300,000 for treatment of the Yuba River at and above Marysville; (4) an annual appropriation of \$20,000 for improving the navigable channel of the Feather River, '91, 2988, 2989.

**SAG HARBOR, N. Y.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 81.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1891. Report, '91, 859.

**Plans.**

By Col. Houston, 1891, for protection of the wharves of the harbor from northeast storms by construction of a riprap breakwater of a total length of 3,180 feet, and extending to 8 feet above mean low water; estimated cost, \$71,000, '91, 861.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Col. Houston, '91, 860.

**SAGINAW RIVER, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 454.)

**Appropriations.**

1866-'87 .....	\$428, 750
1888 .....	65, 000, '88, 1967.
1890 .....	75, 000, '90, 2728.
1892 .....	100, 000, '92, 2458.

Total ..... 668, 750

List of appropriations, '92, 2458.

**Contracts.**

1888. Hubbell & Skeldon, of Detroit, Mich., for dredging, at 28 cents per cubic yard; Q. Gillmore, for dredging, at 49 cents per cubic yard, '89, 2249. Carkin, Stickney & Cram, for revetment and beam-wall construction, and dredging, at 43 cents per cubic yard, '89, 2253.

1891. T. M. Hubbell, for dredging, at 36 cents per cubic yard; Hubbell & Stone, for black ash and Norway pine piles, furnished and driven, at 13 cents per linear foot; J. G. Owen, for white pine timber and plank, at \$20 and \$14 per M feet, B. M.; Carkin, Stickney & Cram, for bolts and nails, at 4.1 cents and 8 cents per pound; McCollum & Lee, for dredging, at 34 cents per cubic yard, '91, 2775.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 263; '89, 311; '90, 280; '91, 351; '92, 336.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1883-'—. Reports, '88, 1963; '89, 2248; '90, 2724; '91, 2772; '92, 2454.

**ASSISTANT.**

B. H. Muehle. Report, '92, 2458.

**Operations.**

History of the work, '88, 1963.

1887-'88. 23,200 cubic yards material dredged from east channel and channel across the bar; repair and extension of beam wall and pile revetment continued above Bay City, '88, 1964.

1888-'89. 23,980 cubic yards material dredged; Carrollton revetment completed to a length of 1,145 feet; plank beam training wall completed, '89, 2249.

1889-'90. 61,956 cubic yards material dredged; '90, 2727.

1890-'91. 16,345 cubic yards material dredged; repairs to Carrollton revetment and Crow Island wing dam, '91, 2774.

1891-'92. 137,992 cubic yards material dredged; repairs to Carrollton revetment and wing dam at Crow Island completed, '92, 2455.

**Projects.**

The project of 1866 proposed the formation, by dredging, of a channel 12 feet deep through the bar off the river's mouth, '66, iv, 59-61; '67, 146; '68, 141.

In 1874 Maj. Weitzel proposed the removal of Carrollton and other bars in vicinity of East Saginaw by dredging and confining the channel by a pile revetment, '74, i, 205, 209; '75, i, 274.

In 1881 Maj. Harwood proposed at and below Bay City securing 14 feet depth in that portion of the channel in front of Bay City, and restoring and deepening the channel of entrance from Saginaw Bay to 14 feet, '81, 2250. Total amount appropriated from 1866 to 1882, \$220,000.

By Board of Engineers, 1882, for removal of snags, logs, and store booms projecting into the channel; for excavation of a channel 12 feet deep and 200 feet wide between the junction of Tittabawassee and Shiawassee rivers and Portsmouth Bridge at Bay City; for excavation of a channel 11 feet deep and 200 feet wide through shoals in the vicinity of Bay City and across bar at mouth of river; estimated cost, \$446,000, '83, 1866, 1867; '84, 2041.

Amount appropriated from 1882 to 1886, inclusive, \$208,750; amount estimated to complete project, \$337,250, '86, 1828.

**SAINT ANDREWS BAY, FLA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 185.

**ENGINEER IN CHARGE.**

Capt. P. M. Price, 1888. Report, '89, 1414.

**SAINT ANDREWS BAY, FLA.—Continued.****Physical Characteristics.**

Description of the locality, '89, 1414.

**Plans.**

In 1889 Capt. Price considered that the existing depth of water in the entrance to the bay was sufficient for the requirements of existing commerce, '89, 1415.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Price, '89, 1414.

**SAINT ANTHONY, MINN.—PRESERVATION OF FALLS OF.**

(See MISSISSIPPI RIVER, PRESERVATION OF FALLS OF SAINT ANTHONY.)

**SAINT AUGUSTINE HARBOR, FLA.—IMPROVEMENT OF DEEP-SEA CHANNEL THROUGH OUTER BAR.**

(Continued from Vol. II, p. 456.)

**Appropriations.**

1829-'87 .....	\$33,569.80
1888 .....	35,000.00, '89, 1311.
1890 .....	20,000.00, '90, 1570.
1892 .....	10,000.00, '92, 1373.

Total ..... 98,569.80

**Commerce.**

Commercial requirements of Saint Augustine, '88, 1126, 1142.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 145, 151; '89, 167, 1312; '90, 149, 426; '91, 188, 195, 1671; '92, 185.

**BOARD OF ENGINEERS.**

Convened at Saint Augustine, January 31, 1889, by S. O. No. 60, to examine and report upon Capt. Black's project for improvement of Saint Augustine Harbor. Report, '89, 1313. (Col. Abbot, Lieut. Col. Hains, and Capt. Bixby.)

Convened at Saint Augustine, Fla., January 26, 1891, by S. O. No. 3, to report upon the establishment of harbor lines in Saint Augustine Harbor. Report, '91, 1687. (Capt. Black and Lieuts. Carter and Gaillard.)

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1886-'92. Reports, '88, 1123; '89, 1309; '90, 1566, 1577; '91, 1630, 1671, 1685.

Maj. J. C. Mallery, 1892-'—. Report, '92, 1371.

**ASSISTANT.**

Lieut. D. D. Gaillard. Reports, '88, 1145; '90, 1571; '91, 1635.

**Operations.**

1887-'89. No operations, '88, 1123; '89, 1309.

1889-'90. 3 groins and 290 linear feet of sand catch built by hired labor, '90, 1567.

1890-'91. Groin No. 2 extended seaward, and groins 4 and 5, aggregating 988 linear feet of new work, built, '91, 1631.

1891-'92. 327 linear feet of sheet pile wing dam built to protect the beach from erosion in the vicinity of Groin No. 4, '92, 1372.

**Physical Characteristics.**

Description of Saint Augustine Harbor and vicinity, '88, 1123, 1129.

Tides and tidal flow, '88, 1131, 1149.

Soundings, borings, channel gauging, measurement of current velocities, and of direction and velocity of winds, '88, 1145, 1153.

Observations on wave action at Saint Augustine Harbor, '91, 1635.

**Plans.**

After examination in 1891 Capt. Black did not consider the harbor worthy of improvement to the extent of joining a deep-sea channel through the outer and inner harbor bars, '91, 1672.

**SAINT AUGUSTINE HARBOR, FLA.—Continued.****Projects.**

By Capt. Black, 1887, for formation of a channel through the bar at the entrance to Saint Augustine Harbor, giving a depth of 16 feet by the construction of two converging brush and riprap jetties, one extending from North Beach and the other from Saint Anastasia Island; estimated cost, \$1,467,888, '88, 1142.

Approved by Board of Engineers, 1889, with the recommendation that \$35,000 be applied to the construction of stone protection on Anastasia Island and North Point (Col. Abbot, Lieut. Col. Hains, and Capt. Bixby), '89, 1316.

**Surveys.**

Survey ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Black, '88, 1128.

Examination for deep-sea channel through outer and inner harbor bars ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Black, '91, 1671.

**MAPS.**

'88, 1142; '89, 1316; '91, 1634.

**SAINT CHARLES, MO.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****SAINT CHARLES BAY, TEX.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 235.

ENGINEER IN CHARGE.

Maj. C. J. Allen, 1891. Report, '91, 1942.

**Plans.**

In 1891 Maj. Allen did not consider the locality worthy of improvement, '91, 1942.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Allen, '91, 1942.

**SAINT CLAIR FLATS SHIP CANAL, MICH.—IMPROVEMENT, OPERATION, AND MAINTENANCE OF.**

(Continued from Vol. II, p. 457.)

**Appropriations.**

1852-'87 .....	\$708, 894. 40
1888 .....	75, 000. 00, '88, 1978.
1890 .....	80, 000. 00, '90, 2739.

Total ..... 863, 894. 40

List of appropriations, '92, 2475.

**Commerce.**

Aggregate annual tonnage passing through canal, '90, 2739.

**Contracts.**

1888. A. J. Dupins, for revetment construction, at \$7.94 per running foot, '89, 2263. Dunbar & Sullivan, for hire of 1 dredge, 1 tug, and 2 dump scows, at \$10 per hour; also 1 dredge and 3 dump scows, at \$8 per hour; Hicklee & Green, for hire of 1 dredge, 1 tug, and 2 dump scows, at \$12 per hour, '89, 2264. W. Richardson, for hire of 1 dredge, 1 tug, and 2 dump scows, at \$8.80 per hour; Hubbell & Skeldon, for hire of same plant as above, at \$10 per hour. Hicklee & Green, for hire of same plant as above, at \$10.75 per hour, '89, 2264.

1890. Steiner & Griffin, for revetment construction, at \$7.88 per running foot; L. E. Allen, for dredging, at 23 cents per cubic yard, '91, 2786.

**SAINT CLAIR FLATS SHIP CANAL, MICH.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 266; '89, 314, 315; '90, 283, 285; '91, 356, 358; '92, 340, 341.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1883.— Reports, '88, 1976; '89, 2260, 2263; '90, 2737, 2739; '91, 2784, 2787; '92, 2473, 2475.

**Operations.**

1887-'88. Operations limited to care of canal, '88, 1976.

1888-'89. 56,117 cubic yards material dredged; 4,082 linear feet sheet piling built, '89, 2261, 2265.

1889-'90. 4,385 linear feet sheet piling built, '90, 2738..

1890-'91. 490 linear feet of sheet piling completed; 43,496 cubic yards material dredged; operation and care of canal, '91, 2786, 2787.

1891-'92. 142,965 cubic yards material dredged; 3,160 linear feet of sheet piling and 90 feet of superstructure completed; operation and care of canal, '92, 2474, 2475.

**Physical Characteristics.**

Description of the locality, '90, 2737.

**Projects.**

The projects of 1866 and 1872 proposed the formation of a channel 200 feet wide, 16 feet deep, and 7,221 feet long, protected on each side by revetment; estimated cost, \$428,754. '66, iv, 57; '67, 28; '72, 216. The canal was completed in 1875, '75, i, 52, 280. Statement of cost of the work, '83, 1878.

By Maj. Farquhar, in 1883, for rebuilding revetment, at an estimated cost of \$153,300, '85, 2160; '86, 1838. Increased to \$200,000 in 1887, '87, 2263. Increased to \$256,000 in 1888, '88, 1976. Increased in 1889, for completion of sheet piling, renewal of decayed portions of harbor superstructure, and dredging channel to depth of 18 feet and full width of 300 feet, to \$276,250, '89, 2262; '91, 2785.

**SAINT CLAIR RIVER AT ALGONAC.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 2285.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1888. Report, '89, 2285.

**Physical Characteristics.**

Description of the locality, '89, 2286.

**Plans.**

In 1888 Col. Poe did not consider that an improvement at Algonac would benefit more than local interests, '89, 2287.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Col. Poe, '89, 2285.

**SAINT CROIX RIVER, ME.—IMPROVEMENT OF.****Appropriations.**

1867-'89 .....	\$39,000
1890 .....	35,000, '91, 570.

Total .....	74,000
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 31; '90, 26; '91, 19; '92, 23.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1888-'92. Reports, '90, 463; '91, 570.

Lieut. Col. P. C. Hains, 1892-'— Report, '92, 494.

**ASSISTANT.**

F. S. Burrowes. Report, '90, 465.



**SAINT CROIX RIVER, ME.—Continued.****Physical Characteristics.**

Description of the locality, '90, 463.

**Projects.**

By Lieut. Col. Smith, 1889, for a channel 12 feet deep at mean low water and 200 feet wide, narrowed to 150 and 100 feet in the upper part of the harbor, to be secured by dredging and 600 linear feet of jetty construction; estimated cost, \$280,000, '90, 466, 467; '92, 494.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Smith, '90, 464.

**SAINT CROIX RIVER, WIS. AND MINN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 459.)

**Appropriations.**

1878-'87.....	\$82,500
1888.....	10,000, '88, 1549.
1890.....	8,000, '90, 2089.
1892.....	8,000, '92, 1838.

Total ..... 108,500

List of appropriations, '91, 2205.

**Commerce.**

Extent of the logging and lumber interests, '91, 2205, 2206; '92, 1839.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 203; '89, 237; '90, 212; '91, 271; '92, 259.

**ENGINEERS IN CHARGE.**

Maj. C. J. Allen, 1878-'90. Reports, '88, 1547; '89, 1798.

Maj. W. A. Jones, 1890-'—. Reports, '90, 2087; '91, 2203; '92, 1837.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1548.

1888-'89. 695 snags, logs, and piles, 3 cubic yards rock, and 3 drift piles removed from the channel, and 125 overhanging trees cleared from the banks; 715 linear feet of wing dam built, '89, 1799.

1889-'90. No operations, '90, 2088.

1890-'91. 25,919 cubic yards material dredged, '91, 2204.

1891-'92. 880 cubic yards material dredged at Hudson Bar; 91 snags removed from the channel, and repairs made to Log House Dam, '92, 1838.

**Projects.**

By Maj. Farquhar, 1874, for the improvement of the river below Saint Croix Falls by the construction of wing dams, removal of boom piers, snags, and overhanging trees, so as to give a low-water depth of 3 feet; estimated cost, \$21,758, '75, i, 375; '78, 100; '79, 1182. There was expended under this project \$18,000.

The present project, adopted in 1880 and modified as to cost in 1882, consists, in addition to the removal of obstructions from the channel between Taylors Falls and Prescott, in the contraction of the low-water channel into one of nearly uniform width, especially at the bars and crossings, by means of brush and stone jetties, and dams of the same material to close island chutes and secondary channels; estimated cost, \$83,450, '88, 203, 204. Increased in 1889 for repairs to existing works, extension of dams at Hudson Bar, construction of wing dams on right bank of the channel, and dredging; revised estimate, \$108,700, '89, 1801; '91, 2204.

**SAINT FRANCIS RIVER, ARK. AND MO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 459.)

**Appropriations.**

1871-'86.....	\$35,000
1888 { Saint Francis River, Ark.....	4,000, '88, 1416.
{ Saint Francis River, Mo.....	5,000, '88, 191.
1890 { Saint Francis River, Ark.....	4,000, '90, 1954.
{ Saint Francis River, Mo.....	10,000, '90, 1955.
1892. Saint Francis River, Ark....	8,000, '92, 1694.

Total ..... 66,000

**SAINT FRANCIS RIVER, ARK. AND MO.—Continued.****Commerce.**

Benefits to be derived from completion of improvement, '88, 1416; '89, 1665; '91, 2061.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 190; '89, 224; '90, 201, 202; '91, 255, 256; '92, 246, 247.

**ENGINEER IN CHARGE.**

Capt. H. S. Taber, 1884-'—. Reports, '88, 1414; '89, 1664, 1666; '90, 1952, 1954; '91, 2059, 2062; '92, 1693, 1694.

**Operations.**

1887-'88. Snagging operations continued, '88, 1415.

1888-'89. Snagging operations continued between the towns of Kennett, Mo., and Saint Francis, Ark.; 216 snags and drift piles removed from the channel, and 50 trees cleared from banks between Greenville and Poplin, Mo., '89, 1664, 1666.

1889-'90. Snagging continued between Kennett and Saint Francis; 309 snags and 4 drift piles cleared from the channel, and 175 overhanging trees from the banks between Wappapello and Poplin, Mo., '90, 1952, 1955.

1890-'91. Snagging operations continued on the upper and lower river, '91, 2060, 2063.

1891-'92. 1,628 snags removed from the upper and lower river, and 5,406 trees cleared from the banks, '92, 1693, 1695.

**Projects.**

By Maj. Benyaurd, 1880, for improvement of the river between Wittsburg and Lester Landing by cutting and marking a channel through the lake region, removing snags and similar obstructions from the bed and banks of the stream. No estimate was made for the completion of this project, and only an appropriation of \$5,000 was made in 1880, '80, 1315; '81, 1434.

In 1887 Capt. Taber proposed the improvement of the river from Greenville to the Arkansas State line by removal of snags and similar obstructions, at an estimated cost of \$7,300, '87, 1550.

**SAINT JEROME BAY, MD.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 145.

**ENGINEER IN CHARGE.**

Lieut. Col. P. C. Hains, 1891. Report, '91, 1278.

**Physical Characteristics.**

Description of the locality, '91, 1278.

**Plans.**

In 1891 Lieut. Col. Hains did not consider the locality worthy of improvement, '91, 1278.

**Surveys.**

Examination made, 1891, under direction of Lieut. Col. Hains, '91, 1278.

**SAINT JEROMES CREEK, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 460.)

**Appropriations.**

1881-'84 ..... \$26,500

List of appropriations, '88, 819.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 110; '89, 127; '90, 114.

**ENGINEER IN CHARGE.**

S. T. Abert, U. S. agent, 1881-'—. Reports, '88, 818; '89, 1005; '90, 1034.

**Operations.**

1887-'90. No operations for lack of funds, '88, 819; '89, 1005; '90, 1064.

**SAINT JEROMES CREEK, MD.—Continued.****Projects.**

By S. T. Abert, 1880, for excavation of a channel 100 feet wide and 9 feet deep through the bar at the mouth of Saint Jeromes Creek, and a channel 40 feet wide and 6 feet deep into the south fork of the same, the material to be formed into a dike inclosing a part of the south fork for a pond for the U. S. Fish Commission; estimated cost, \$21,500.

From 1881 to 1886, inclusive, \$26,500 had been appropriated, when the amount to complete project was estimated at \$26,000, '85, 970; '87, 984. Increased to \$34,700 in 1888, '88, 819.

In 1890 the project was reduced to the excavation of a channel through the bar at the mouth of the creek, at an estimated cost for completion of \$26,000, '90, 1065.

**SAINT JOHNS RIVER, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 462.)

**Appropriations.**

1852-'87 .....	\$769, 000
1888 .....	175, 000, '88, 1087.
1890 .....	170, 000, '90, 1557.
1892 .....	112, 500, '92, 1357.

Total ..... 1, 226, 500

**Commerce.**

Commercial interests, '88, 1087, 1088.

Present and prospective commercial development, '90, 1556.

**Contracts.**

1889. R. G. Ross, for furnishing stone, at from \$2.14 to \$2.35 per ton; oyster shell, at \$1.25 per cubic yard, and brush mattress, at 74 cents per cubic yard, '89, 1305.

1890. M. Conant, for jetty construction, at a total of \$126,420, '91, 1617.

1891. J. Satterlee, for furnishing stone, at \$4.17 per ton, '91, 1618.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 143; '89, 165; '90, 147; '91, 185, 195, 1666; '92, 182.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1886-'92. Reports, '88, 1079; '89, 1298; '90, 1549; '91, 1612, 1667.

Maj. J. C. Mallery, 1892-'—. Report, '92, 1349.

**ASSISTANTS.**

J. H. Bacon. Reports, '89, 1306; '90, 1558; '91, 1618.

E. A. Gieseler. Report, '92, 1357.

**Operations.**

1887-'88. 7,204 cubic yards stone and shell used in the south jetty; 12,000 square yards of mattress, 21,951 cubic yards stone, and 2,309 cubic yards shell placed in the north jetty; also 286 cubic yards concrete, '88, 1081.

1888-'89. 19,361 tons of stone, 1,522 cubic yards oyster shells, and 20,000 square yards of brush mattress placed in the north jetty, '89, 1299.

1889-'90. 13,000 square yards brush mattress, 21,121 tons stone, and 3,476 cubic yards oyster shells placed in north and south jetties, '90, 1551.

1890-'91. 4,240 cubic yards material dredged, 3,731 cubic yards stone placed in south jetty, and 14,783 square yards of brush mattress and 7,866 cubic yards stone placed in north jetty, '91, 1613.

1891-'92. 14,586 square yards mattress and 14,192 cubic yards of stone placed in south jetty, and 10,773 square yards of mattress and 11,157 cubic yards stone placed in north jetty; also 227 cubic yards concrete coping laid, '92, 1351. In 1892 the south jetty had been completed to a total length of 8,293 feet, and the north jetty to 10,991 feet, '92, 1352.

**Physical Characteristics.**

Tidal observations, '88, 1085; '89, 1301; '90, 1561.

Density of water and sediment, '89, 1302.

Velocity of current, '89, 1306; '90, 1558.

Low-water cross-sectional areas and mean depths at the mouth of the Saint Johns River from 1883 to 1892, '92, 1358.

Tidal data, '92, 1360, 1362.

Surface areas of Saint Johns River, '92, 1361.

**SAINT JOHNS RIVER, FLA.—Continued.****Projects.**

By Lieut. Col. Gillmore, 1879, for jetties at the mouth of Saint Johns River; the north jetty to be 9,400 feet long, with its inner end on Fort Georges Island; the south jetty to be 6,800 feet in length, with inner end on the mainland below Generals Mound; width between jetties, 1,600 feet; both jetties to be submerged from shore to a point 2,000 feet from the sea ends, the rest at the level of half tide; the jetties to extend to the 16-foot curve, and to produce a mid-channel depth of from 15 to 16 feet at mean low water; estimated cost, \$1,306,409, '79, 784, 785. Increased in 1888 to \$1,428,409, '89, 1298.

In 1891 an increased length of jetty being required to meet the growth of the bar seaward, the estimated cost was increased to \$1,622,000, '91, 1618.

In 1892 it was proposed to deepen the ship channel in the defective reach, Dames Point to Beacon No. 1, by dredging, and protection by dikes and shore protection; estimated cost, \$324,000. This work is now being carried out by means of an appropriation of \$300,000 made by Duval County. Estimated cost of entire improvement increased to \$1,741,000, '92, 1350.

**Surveys.**

Of the bar between the ends of the jetties, 1888, '88, 1084.

Of the river from Great Marsh Island to Front Creek, '90, 1558.

Examination from Jacksonville to Sandford ordered by act of September 19, 1890.

Made, 1891, under direction of Capt. Black, '91, 1667.

**MAPS.**

'88, 1086; '89, 1304; '90, 1560; '91, 1618; '92, Atlas, 61, 62, 63, 64.

**SAINT JOHNS RIVER (UPPER), FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 461.)

**Appropriations.**

1884..... \$4,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 143; '91, 195, 1666.

ENGINEER IN CHARGE.

Capt. W. M. Black, 1886'— Reports, '88, 1090; '91, 1667.

**Operations.**

Deferred to await further appropriations, '88, 1091.

**Plans.**

In 1891 Capt. Black did not consider the upper river worthy of improvement, '91, 1669.

**Projects.**

By Lieut. Col. Gillmore, 1884, for improvement of the Upper Saint Johns River for a channel width of 100 feet and depth of 6 feet by excavation of curved cut-offs, dredging, and the construction of closure dams; estimated cost, \$38,800, '84, 1137; '87, 1220.

**SAINT JONES RIVER, DEL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 464.)

**Appropriations.**

1881-'87..... \$25,000

1888..... 15,000, '88, 743.

Total..... 40,000

List of appropriations, '90, 926.

**Commerce.**

Reduction in freight rates consequent upon improvement, '88, 743.

**Contracts.**

1889. F. C. Somers, for dredging, at 18 cents per cubic yard, and for placing fender piles, at \$8 per running foot, '89, 888.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 89; '89, 104; '90, 95; '91, 122.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1885'— Reports, '88, 742; '89, 887; '90, 925; '91, 1165.

**SAINT JONES RIVER, DEL.—Continued.****Operations.**

1887-'88. 5,482 cubic yards material dredged from channel and bar at entrance, '88, 742.

1888-'89. No operations, '89, 887.

1889-'90. 58,015 cubic yards material dredged, '90, 925.

1890-'91. No operations; improvement completed and no further appropriation needed, '91, 1165.

**Projects.**

By Col. Macomb, 1881, for excavation of a channel through the bar at the river's mouth and at other points to a depth of 3 feet mean low water, with a width of channel from 200 to 250 feet; also for construction of 3,300 linear feet of jetty at the entrance; estimated cost, \$35,000, '81, 799, 801; '87, 831.

Improvement completed in 1891, after an expenditure of \$40,000, '91, 1165.

**SAINT JOSEPHS HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 465.)

**Appropriations.**

1836-'87 .....	\$335, 113
1888 .....	12, 000, '88, 1918.
1890 .....	20, 000, '90, 2660.
1892 .....	60, 000, '92, 2361.

Total ..... 427, 113

List of appropriations, '92, 2360.

**Contracts.**

1889. J. M. Allmendinger, for pile and timber wing dam, at a total of \$2,895, '89, 2196.

1891. F. A. Hagen, for stone, at \$2.25 per cord; E. G. Crosby, for pine timber, at \$18 per M feet, B. M.; J. M. Allmendinger, for pine piles, at 15 cents per linear foot; white pine plank, at \$16 per M feet, B. M., and brush, at \$2.75 per cord; E. B. Mather, for bolts and spikes, at 3½ cents per pound, '91, 2704.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 257; '89, 303; '90, 272; '91, 343; '92, 329.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1917.

Maj. W. Ludlow, 1889— . Reports, '89, 2194; '90, 2658; '91, 2702; '92, 2357, 2362.

**Operations.**

1887-'88. Filling in pile revetment renewed; 476 linear feet of old rock filling and superstructure renewed; 14,850 cubic yards material dredged, '88, 1918.

1888-'89. 176 linear feet of wing dam built; 24,840 cubic yards material dredged, '89, 2195.

1889-'90. Repairs to north pier; 11,905 cubic yards material dredged, '90, 2659.

1890-'91. 27,000 cubic yards material dredged, '91, 2703.

1891-'92. 57,520 cubic yards material dredged; repairs to north revetment completed, and incomplete portion of south pier superstructure finished, '92, 2359.

**Projects.**

For projects prior to 1886, see Vol. I, page 487, Index to Reports of the Chief of Engineers.

From 1836 to 1865, inclusive, \$156,113 was appropriated, '66, iii, 35. The projects of 1866 and 1874 proposed the formation of a channel of entrance not less than 16 feet deep, '66, iv, 111, 112; '75, i, 265; '76, ii, 518.

In 1880 the project was modified by the improvement of Benton Harbor Channel to a depth of 12 feet, together with the revetment of the north bank for a distance of 2,500 feet, '80, 2031.

From 1866 to 1886, inclusive, \$179,000 was appropriated, when it was estimated that \$41,015 would be required to complete project, '86, 316; '87, 2201.

In 1891 Maj. Ludlow proposed the reconstruction of 370 feet of old crib work in the north pier, refilling north revetment, minor repairs to piers and wing wall, and dredging and extension of north pier 120 feet; estimated cost, \$145,000, '92, 2360.

**SAINT JOSEPH, MO.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****SAINT JOSEPHS RIVER, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 466.)

**Appropriations.**

1888.....	\$2,500, '89, 2197.
1890.....	1,000, '90, 2662.

Total .....	3,500
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 258; '89, 304; '90, 273; '91, 343; '92, 330.

**ENGINEER IN CHARGE.**

Maj. W. Ludlow, 1888.— Reports, '89, 2196; '90, 2662; '91, 2705; '92, 2363.

**Operations.**

1887-'89. No operations, '88, 258; '89, 2196.

1889-'90. 400 linear feet of log, brush, and stone dam built by hired labor, '90, 2661.

1890-'91. 4 wing dams built, '91, 2706.

1891-'92. 4 wing dams built, and 318 snags and 7 bowlders removed, '92, 2364.

**Projects.**

By Maj. Harwood, 1880, for improvement of the river from its mouth to Berrien Springs by the construction of wing dams, dredging, and the removal of snags and other obstructions; estimated cost, \$11,300, '88, 258.

By Maj. Ludlow, 1889, for securing a depth of 3 to 4 feet from Saint Joseph to Berrien Springs, a distance of 25 miles, by removal of snags and bowlders, and the construction of wing dams, '92, 2363.

**SAINT LAWRENCE RIVER, N. Y.—SURVEY OF SHOALS BETWEEN THE SISTER ISLANDS AND CROSSOVER LIGHT.****Appropriations.**

1890.....	\$5,000, '91, 2922.
1892.....	10,000, '92, 2600.

Total .....	15,000
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 344; '91, 383; '92, 362.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1888.— Reports, '89, 2462; '91, 2922; '92, 2599.

**ASSISTANT.**

F. M. Barstow. Report, '89, 2463.

**Physical Characteristics.**

Description of the locality, '89, 2462.

**Plans.**

By Maj. Adams, 1889, for removal of three rock shoals in the channel to a depth of 18 feet at low water, at an estimated cost of \$43,305, '89, 2464; '91, 2922.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Adams '89, 2463.

**SAINT LEONARDS CREEK, MD.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 145, 1277.

**ENGINEER IN CHARGE.**

Lieut. Col. P. C. Hains, 1891. Report, '91, 1277.

**SAINT LEONARDS CREEK, MD.—Continued.****Physical Characteristics.**

Description of the locality, '91, 1277.

**Plans.**

In 1890 Lieut. Col. Hains did not consider the prospective benefits to existing commerce warranted an improvement, '91, 1278.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Hains, '91, 1277.

**SAINT LOUIS HARBOR, MO.—IMPROVEMENT OF.****Appropriations.**

1890..... \$182,000, '91, 2110.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 230; '91, 260; '92, 250.

**ENGINEER IN CHARGE.**

Maj. A. M. Miller, 1888-'— Reports, '89, 1711; '91, 2109; '92, 1737.

**ASSISTANTS.**

D. M. Currie. Reports, '91, 2110; '92, 1738.

J. O. Holman. Reports, '91, 2110; '92, 1738.

**Operations.**

1890-'91. 12,400 linear feet of hurdle dike built, '91, 2109.

1891-'92. 1,685 linear feet of hurdle dike built, '92, 1783.

**Projects.**

By Maj. Miller, 1888, for removal of bars in the upper harbor by the construction of 19,800 linear feet of permeable pile and brush contraction works; estimated cost, \$181,863, '89, 1712.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Miller, '89, 1711.

**MAPS.**

'91, 2110; '92, Atlas, 89.

**SAINT LOUIS RIVER, MINN.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 317; '92, 302.

**ENGINEERS IN CHARGE.**

Maj. J. B. Quinn, 1890. Report, '92, 2143.

Col. O. M. Poe, 1890. Report, '92, 2148.

Capt. W. L. Fisk, 1891. Report, '92, 2151.

**ASSISTANT.**

J. H. Darling. Report, '92, 2152.

**Physical Characteristics.**

Description of the locality, '92, 2151.

**Plans.**

By Capt. Fisk, 1891, for the formation of a channel, by dredging where necessary, 100 feet wide at bottom and 16 feet deep up to Fond du Lac, at an estimated cost of \$113,000, '92, 2151.

**Surveys.**

Survey from Grassy Point in Saint Louis Bay to Fond du Lac. Made, 1891, under direction of Capt. Fisk, '92, 2151.

**SAINT LOUIS, MO.—(See MISSISSIPPI RIVER BETWEEN THE MOUTHS OF THE ILLINOIS AND OHIO RIVERS.)**

**SAINT MARKS RIVER, FLA.—EXAMINATION OF.**

(Continued from Vol. II, p. 467.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 175.

ENGINEER IN CHARGE.

Capt. W. M. Black, 1888. Report, '89, 1364.

ASSISTANT.

D. B. Dunn. Report, '89, 1365.

**Physical Characteristics.**

Description of the locality, '89, 1364.

**Plans.**

By Capt. Black, 1889, for improvement of the river by straightening and deepening the channel, and removal of rock obstructions; estimated cost, \$39,000, '89, 1364.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Black, '89, 1364.

**SAINT MARYS RIVER AND SAINT MARYS FALLS CANAL, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 468.)

**Appropriations.**

1856-'79 .....	\$2, 412, 900.22
1880-'81. Saint Marys Falls Canal and River.....	400, 000.00
1882-'86. Saint Marys River (Hay Lake Channel) ..	475, 000.00
1886. Saint Marys Falls Canal.....	250, 000.00
1888 { At Falls.....	1, 000, 000.00, '88, 1928.
{ Hay Lake Channel.....	500, 000.00, '88, 1957.
1890 { At Falls.....	900, 000.00, '90, 2688.
{ Hay Lake Channel.....	400, 000.00, '90, 2718.
{ At the Falls.....	* 600, 000.00, '92, 2403.
1891 { Hay Lake Channel.....	* 300, 000.00, '92, 2447.
1892. Hay Lake Channel.....	115, 000.00, '92, 2447.

Total ..... 7, 352, 900.22

**Commerce.**

1888. Commerce passing the canal, '88, 260, 1930, 1931, 1932, 1933, 1941.

1889. Commerce passing the canal, '89, 2213, 2214, 2218, 2227.

1890. Commerce passing the canal, '90, 2690, 2691, 2710.

Comparison of freight charges by rail and water, '88, 1933, 1934.

Freight charges on merchandise passing through the canal, '88, 1935; '89, 2220.

Effect of accident at Saint Marys Falls Canal upon passage of vessels through the lock, '91, 2743, 2746.

Freight rates on articles of commerce through the canal for 1887, 1888, 1889, and 1890, '91, 2753.

**Contracts.**

1887. H. D. Edwards &amp; Co., for ship chandlery, at \$625.39; Johnston &amp; Goss, for lumber, at \$420; G. Kemp, for coal, at \$743; T. B. Rayl &amp; Co., for hardware, at \$285.19, '88, 1928. T. B. Rayl &amp; Co., for hardware, at \$436.86; Johnston &amp; Goss, for lumber, shingles, and lime, at \$557.25; W. W. Leggett, for electric-light supplies, at \$794.13; W. D. Edwards &amp; Co., for ship chandlery, at \$1,670.65; J. E. Davis, for paints and oils, at \$678.97, '88, 1942. T. B. Rayl &amp; Co., for hardware, at \$436.86; G. Kemp, for coal, at \$360; Richmond &amp; Backus Company, for stationery, at \$318.64, '88, 1954.

1888. Hickle &amp; Green, for drilling and blasting, at \$4.47 per hole, '88, 1929. Richmond &amp; Backus Company, for stationery, at \$318.64; W. R. Santley, for white oak timber, at \$54 per M feet, B. M.; Burnett &amp; Stachan, for one oil tank, at \$147; Hickle &amp; Green, for castings, at \$216, '88, 1942. Hickle &amp; Green, for repairs to tug, at \$261; N. C. Morgan &amp; Co., for supplies, \$293.12; G. &amp; R. McMillan, for vegetables, at \$228.80, '88, 1958. L. E. Allen, for pier construction, at \$49,042, '88, 1959.

1889. Collins &amp; Farwell, for lock-pit excavation, at \$220,667; Richmond &amp; Backus Company, for stationery, at \$751.01; P. M. Church &amp; Co., for hardware, at

\* Sundry civil bill, '92, 2403, 2447.



# **SAINT MARYS RIVER AND SAINT MARYS FALLS CANAL, MICH.—Continued.**

## **Contracts—Continued.**

- \$386.03; P. M. Church & Co., for ship chandlery, at \$1,089; Johnson & Goss, for lumber, at \$420; Johnson & Goss, for wood and mill slabs, at \$212.50; Gray & Buffy for four map cases, at \$80; Soo City Machine Company, for machine work, at \$245; S. C. Forsaith Machine Company, for "Cameron" steam pump and equipment, at \$1,137.11, '89, 2215. Richmond & Backus Company, for stationery supplies, at \$446.28; P. M. Church, for hardware, at \$95.53; P. M. Church, for ship chandlery, at \$334.52; H. M. Loud, for lumber, at \$6,192.50; Soo City Machine Company, for machine work, at \$245; P. M. Church, for ship chandlery, at \$633.75; Union Dock and Canal Company, for coal, at \$727; W. C. Morgan & Co., for vegetables, at \$439.80; W. C. Morgan & Co., for meats, at \$350; Soo City Machine Company, for machine work, at \$245, '89, 2243. H. D. Edwards & Co., for two diving suits, at \$32 per dress; Fletcher, Jenks & Co., for round iron, at \$1.93½ per pound; G. Kemp, for coal, at \$334.50; F. Williams & Co., for oil, at \$180 to \$300; P. M. Church, for hardware, at \$1,032.56; R. G. Ferguson & Co., for ship chandlery, at \$557.94; P. M. Church & Co., for electric-light supplies, at \$276.70; R. G. Ferguson & Co., for paints and oils, at \$215.98; Johnson & Goss, for pine timber and lumber, at \$2,682; Johnson & Goss, for oak timber, at \$216.97; Union Dock and Coal Company, for coal, at \$440; Soo City Machine Company, for machine work, at \$220, '90, 2700, 2701.
1890. R. G. Ferguson, for hardware, at \$478.65; R. G. Ferguson, for hardware, at \$87.19; Johnson & Goss, for lumber and shingles, at \$375; J. Hickler & Son, for coal, at \$1,358.80; Soo City Machine Company, for machine work, at \$2.20 per hour; P. M. Church, for hardware, at \$92.71; P. M. Church, for ship chandlery, at \$87.19; J. Hickler & Son, for coal, at \$577.50; G. and R. McMillan & Co., for groceries, at \$26.48; P. Cameron, for meats, at \$195; G. F. Old, for vegetables, at \$196, '90, 2718.
1891. Hughes Bros. & Bangs, for furnishing all materials and building the masonry of a lock at Saint Marys Falls Canal, at a total of \$1,268,500, '91, 2720. R. G. Ferguson & Co., for hardware, at a total of \$417.80; H. D. Edwards & Co., for ship chandlery, at a total of \$425.88; C. Hebard & Sons, for lumber, at a total of \$367.50; G. Kemp, for coal, at a total of \$1,292, '91, 2720. J. Strachan, for machine work, at a total of \$215; J. H. Killmaster & Co., for white pine, at \$22 per M feet, and hemlock timber, at \$13.50 per M feet; Fletcher, Jenks & Co., for drift bolts, at 2½ cents, and spike, at 2½ cents per pound, '91, 2721. W. S. Pope, for furnishing two lock valves, at a total of \$1,563.30; R. G. Ferguson, for hardware, at a total of \$719.28; P. M. Church & Co., for ship chandlery, at a total of \$1,087.66; Williams, Shely & Brooks, for paints and oils, at a total of \$511.76; E. D. Weimer, for pine timber, at a total of \$7,310; T. R. Forsyth, for white oak timber, at a total of \$499.44; R. G. Ferguson & Co., for electric-light supplies, at \$78.90; G. Kemp, for coal, at \$382; J. Strachan, for oil tanks, at \$445, '91, 2729. Russell Wheel and Foundry Company, for four valve frames, at a total of \$1,367.30, '91, 2730. The following contracts were entered into for Hay Lake Channel: J. Hickler, for dredging, at \$1.20 per cubic yard in bank; Dunbar & Sullivan, for dredging, at 57 cents per cubic yard; Carlin, Stickney & Cram, for dredging, at 14½ cents per cubic yard; C. F. & H. T. Dunbar, for dredging, at 14 cents per cubic yard; Carlin, Stickney & Cram, for dredging, at 13 cents per cubic yard; Carlin, Stickney & Cram, for dredging, at 14½ cents per cubic yard; Richmond & Backus Company, for stationery, at a total of \$1,043.32; B. G. Ferguson & Co., for hardware, at a total of \$37.42; H. D. Edwards & Co., for ship chandlery, at a total of \$139.78; G. Kemp, for coal and wood, at a total of \$580; G. and R. McMillan & Co., for groceries, at a total of \$189, '91, 2763. J. Strachan, for machine work, at a total of \$215, '91, 2764. King Iron Bridge and Manufacturing Company, for iron work, at a total of \$20,477; J. Ryan, for delivering clay, at a total of \$2,632, '92, 2403.
1892. R. G. Ferguson, for hardware, at \$341; P. M. Church & Co., for ship chandlery, at \$511; Richards & Co., for chemicals, at \$95.25; C. Hebard & Son, for lumber, at \$367.50; G. Kemp, for coal, at \$1,246; J. Strachan, for machine work, at \$200; J. P. McGuire, for 12 valve frames, at a total of \$26,862.96, '92, 2404. The following contracts were entered into under operation and care of canal: P. M. Church & Co., for hardware, at \$313.97; R. G. Ferguson & Co., for ship chandlery, at \$539.72; P. M. Church & Co., for paints and oils, at \$374.64; Chas. Hebard & Sons, for lumber, at \$1,057.50; P. M. Church & Co., for electric-light supplies, at \$148.20; G. Kemp, for coal, at \$500; J. Strachan, for machine work, at a total of \$200, '92, 2436. The following contracts were entered into under the Hay Lake Channel improvement: R. G. Ferguson, for hardware, at \$65.17; P. M. Church & Co., for ship chandlery, at \$629.42; D. Wallace, for groceries, at \$219.97; G. Kemp, for coal, at \$565; J. Strachan, for machine work, at \$200, '92, 2448.

**SAINT MARYS RIVER AND SAINT MARYS FALLS CANAL,  
MICH.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 259, 260, 261; '89, 307, 308; '90, 275, 276, 277; '91, 345, 346, 347; '92, 331, 332, 333.

**ENGINEER IN CHARGE.**

Col. O. M. Poe, 1883.— Reports, '88, 1924, 1930, 1932, 1937, 1953, 1954; '89, 2210, 2218, 2220, 2223, 2237, 2238; '90, 2684, 2690, 2695, 2710, 2714; '91, 2712, 2722, 2724, 2739, 2752, 2758; '92, 2398, 2421, 2426, 2430, 2443.

**ASSISTANT.**

E. S. Wheeler. Report, '92, 2404.

**Operations.**

1887-'88. Progress on new lock, '88, 1925. 1,224 linear feet of pier extension and cofferdam crib work completed, and 2,115 cubic yards clay puddling placed in cofferdam; 32,165 cubic yards material dredged from channel in front of Fort Brady Reservation, '88, 1925. Dredging in canal above movable dam, '88, 1926. Operation and care of canal, '88, 1937, 1943. Progress on dry dock, '88, 1953. Dredging at Middle Neebish, '88, 1955.

1888-'89. 49,669 cubic yards puddling clay placed in cofferdam, '89, 2211. Excavation of lock pit begun, and 10,589 cubic yards material removed; rock removal above movable dam completed, '89, 2212. Pile pier at Fort Brady begun, and 1,460 linear feet of piling driven, '89, 2213. Operation and care of canal, '89, 2223, 2229. 46,520 cubic yards material dredged from Hay Lake Channel, '89, 2238. Progress in excavation of Middle Neebish Channel, '89, 2239, 2240.

1889-'90. 12,638 cubic yards puddling clay placed in cofferdam, '90, 2685. 95,261 cubic yards earth and 9,956 cubic yards rock excavated from lock pit; 4,961 cubic yards stone removed from old lock walls and piled; 30,293 cubic yards of material placed behind Fort Brady Pier; pier at Fort Brady completed to length of 1,434 feet, '90, 2686. Operation and care of canal, '90, 2695. Progress on Middle Neebish Channel, '90, 2716.

1890-'91. Repairs to break in cofferdam, '91, 2713. 120,880 cubic yards earth and rock removed in excavation of lock pit, 468 cubic yards of retaining wall built, and 35,139 cubic yards of material placed behind Fort Brady Pier, '91, 2715. Masonry construction in progress, '91, 2716. Operation and care of canal, '91, 2724. 20,958 cubic yards material dredged from channel at Middle Neebish, '91, 2761.

1891-'92. 5,764 cubic yards material removed in excavation of lock pit; 8,478 cubic yards of concrete and 9,547 cubic yards of cut stone and backing stone laid, '92, 2399. 12,000 cubic yards of material removed in excavation of a channel around a vessel sunk in the canal, '92, 2421. Operation and care of canal, '92, 2426. 921,732 cubic yards material dredged at Hay Lake Channel, '92, 2445, 2446.

**Physical Characteristics.**

Mean elevation of Lake Superior water surface above sea level for 1887-'88, '88, 1927. Mean elevation of Lake Superior water surface above mean tide at New York, '90, 2692.

**Projects.**

In 1852 a grant of 750,000 acres of public land was made to the State of Michigan for the construction of the canal; the grant was transferred to a company who completed the canal and turned it over to the State in 1856, at a cost of \$999,802.46; the canal as thus built was 100 feet wide and 12 feet deep, provided with 2 locks 350 feet long and 70 feet wide, with lifts of 9 feet, '66, iv, 66; '70, 160; '77, 922; '86, 1792.

Previous to 1870 \$210,692 was appropriated by Congress and applied to the improvement of the channel of the river through Lake George and the west channel of East Neebish, '82, 2361; '86, 1793.

In 1869 the State of Michigan provided for the future transfer of the canal to the United States, '69, 106; '70, 163.

In 1870 Congress made the first appropriations for the enlargement of the canal to a width of 100 to 500 feet, with a depth of 16 feet, together with the construction of a new lock 515 feet long, 80 feet wide, and 18 feet lift, at an estimated cost of \$2,460,000, '70, 160; '71, 163; '77, 922; '79, 1644; '82, 2361; '86, 1795.

In 1881 the canal was transferred to the United States by the State of Michigan, '84, 2030.

The canal enlargement was completed in 1883, at a cost of \$2,171,000, '82, 2342; '86, 1783, 1801, 1806.

In 1880 Col. Weitzel proposed the further improvement of the channels of Saint Marys River, except through East Neebish, so as to obtain a channel 300 feet wide and 16 feet deep, at an estimated cost of \$225,000, '80, 2074.

**SAINT MARYS RIVER AND SAINT MARYS FALLS CANAL,  
MICH.—Continued.****Projects—Continued.**

In 1882 Col. Weitzel proposed the formation of a channel 300 feet wide and 17 feet deep passing through Sugar Island Rapids and Hay Lake, rejoining the American Channel via Middle Neebish; estimated cost, \$2,127,292, '82, 2367; '83, 1836; '84, 2004; '86, 1802, 1805.

In 1885 the proposed depth was increased to 20 feet and the estimated cost to \$2,659,115, '85, 2100; '86, 1778; '87, 2238, 2245.

By Lieut. Col. Poe, 1884, for a new lock 70 feet wide, 700 feet long, with 21 feet depth, built upon the site of the old locks, with a deepening of the canal above and below the lock; estimated cost, \$1,609,085, '84, 2012. Increased in 1885 to \$1,750,000, '85, 2105. Revised in 1886 to \$2,552,176, '86, 1735.

By Lieut. Col. Poe, 1884, for a dry dock 330 feet long and 18 feet deep, located near east end of area transferred from Fort Brady Military Reservation; estimated cost, \$323,872, '84, 2033; '85, 2125.

Objections against use of old locks for dry docks, '84, 2030; '85, 2115.

History of past operations, '86, 1792.

In 1886 Col. Poe revised the plan and estimates of 1881 for the canal enlargement, wherein the proposed new lock was increased to 800 feet between the gates, 100 feet wide throughout, with 21 feet of water on miter sills; estimated cost, \$4,738,865, '87, 2215, 2217, 2220, 2223.

**Surveys.****MAPS.**

'88, 1927, 1956; '90, 2716; '91, 2759; '92, Atlas, 112.

**SALEM HARBOR, including South River, Mass.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 470.)

**Appropriations.**

1873-'79 .....	\$25,000
1890 .....	14,000, '91, 640.
1892 .....	14,000, '92, 571.

Total .....	53,000
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List of appropriations, '92, 571.

**Contracts.**

1890. A. R. Wright, for dredging, at 22 cents per cubic yard, and removal of bowlders, at \$5 each, '91, 641.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 44; '90, 38; '91, 38; '92, 44.

**ENGINEER IN CHARGE.**

Lieut. Col. S. M. Mansfield, 1888-'—. Reports, '90, 528; '91, 639; '92, 570.

**ASSISTANT.**

S. Haagensen. Report, '90, 530.

**Operations.**

1891-'92. 50,213 cubic yards material dredged; rock ledge near Derby Wharf Light removed, '92, 571.

**Physical Characteristics.**

Description of the locality, '90, 531.

**Projects.**

By Lieut. Col. Mansfield, 1889, for improvement of the entrance to South River by excavation of a channel 5,100 feet in length, 100 to 300 feet wide, and from 6 to 8 feet deep at mean low water; estimated cost, \$28,000, '90, 530; '91, 640.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Mansfield, '90, 529.

**SALEM RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 471.)

**Appropriations.**

1871-'82 .....	\$14,500
1892 .....	2,500

Total .....	17,000
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**SALEM RIVER. N. J.—Continued.****Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 84.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert, 1885-'88. Report, '88, 712.

**Operations.**

1887-'88. No operations, '88, 712.

**Physical Characteristics.**

Description of the river, '88, 712.

**Plans.**

Col. Robert, 1888, recommended that further improvements be postponed to await increase in commerce, '88, 712.

**Projects.**

Between 1871 and 1881 \$10,000 was applied toward the formation of a channel 8 feet deep at mean low water through the bar obstructing the mouth of the river, '71, 695; '78, 442; '79, 413; '80, 593; '81, 791.

In 1881 operations were transferred to the formation of a channel 60 feet wide and 6 feet deep at low water through the shoals above the head of the canal, '81, 791; '87, 84.

**SALKEHATCHIE RIVER, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 472.)

**Appropriations.**

1882-'87 .....	\$10,000
1888 .....	3,000, '88, 989.
1890 .....	5,000, '90, 1210.

Total ..... 18,000

List of appropriations, '88, 989.

**Commerce.**

Commerce of the river, '88, 989.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 137; '89, 152; '90, 137; '91, 178; '92, 175.

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888-'— Reports, '88, 987; '89, 1171; '90, 1209; '91, 1482; '92, 1235.

ASSISTANT.

J. P. Allen. Reports, '89, 1173; '90, 1210; '91, 1484.

**Operations.**

1887-'88. No operations, '88, 988.

1888-'89. 203 snags and logs removed from river channel, and 249 trees and 14 cords of brush removed from the banks, '89, 1172.

1889-'90. 278 trees and logs removed from the channel, and 19 trees and 4 cords brush cut from the banks, '90, 1211.

1890-'91. 82 logs and snags removed from the channel, and 66 trees and 10 cords of brush cleared from the banks, '91, 1484.

1891-'92. No operations; improvement reported as meeting the requirements of existing commerce, '92, 1236.

**Projects.**

By Col. Gillmore, 1880, for improvement of the river by removal of pile obstructions at Hickory Hill, and removal of logs and shoals for a distance of 65 miles to render the river navigable for rafts and flatboats; estimated cost, \$18,000, '81, 1144; '87, 1146; '92, 1235.

**SALMON RIVER, LAKE ONTARIO, N. Y.—EXAMINATION OF.**

(Continued from Vol. II, p. 473.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 337.

ENGINEER IN CHARGE.

Capt. C. F. Palfrey, 1888. Report, '89, 2427.

**SALMON RIVER, LAKE ONTARIO, N. Y.—Continued.****Physical Characteristics.**

Description of the locality, '89, 2428.

**Plans.**

In 1889 Capt. Palfrey did not consider the locality worthy of improvement as a harbor of refuge, '89, 2429.

**Surveys.**

Examination for harbor of refuge ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Palfrey, '89, 2427.

**MAPS.**

'89, 2428.

**SALMON RIVER, N. Y.—SURVEY OF.**

(Continued from Vol. II, p. 473.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 344.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1888. Report, '89, 2460.

**ASSISTANT.**

F. M. Barstow. Report, '89, 2461.

**Physical Characteristics.**

Description of the locality, '89, 2461.

**Plans.**

By Maj. Adams, 1888, for a 7-foot channel 75 feet in width from the railroad bridge at Fort Covington to the International Line; estimated cost, \$20,000, '89, 2460.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Adams, '89, 2461.

**MAPS.**

'89, 2460.

**SALT RIVER, KY.—SURVEY OF.**

(Continued from Vol. II, p. 473.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '88, 229.

**ENGINEER IN CHARGE.**

Maj. A. Stickney, 1888. Report, '88, 1799.

**ASSISTANTS.**

Lieut. W. L. Sibert. Report, '88, 1800.

W. R. Curtis. Report, '88, 1800.

**Physical Characteristics.**

Description of the locality, '88, 1798.

**Plans.**

By Maj. Stickney, 1888, for improvement of 11 miles of river above Keys Ripple by construction of a lock and dam with a lift of 10 feet, giving a navigable depth of 5 feet for  $8\frac{1}{2}$  miles, and  $2\frac{1}{2}$  feet for the remaining  $2\frac{1}{2}$  miles; estimated cost, \$175,000, '88, 1799.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Maj. Stickney, '88, 1799.

**SAN BUENAVENTURA HARBOR, CAL.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 348.

**ENGINEER IN CHARGE.**

Maj. W. H. H. Benyard, 1888. Report, '89, 2479.

**SAN BUENAVENTURA HARBOR, CAL.—Continued.****Physical Characteristics.**

Description of the locality, '89, 2479.

**Plans.**

In 1888 Maj. Benyaurd did not consider the locality worthy of improvement, '89, 2479.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Maj. Benyaurd, '89, 2479.

**SAND BEACH, LAKE HURON, MICH.—CONSTRUCTION OF HARBOR OF REFUGE AT.**

(Continued from Vol. II, p. 473.)

**Appropriations.**

1871-'87 .....	\$1,060,000
1888 .....	70,000, '88, 1970.
1890 .....	30,000, '90, 2732.
1892 .....	150,000, '92, 2467.

Total ..... 1,310,000

List of appropriations, '92, 2467.

**Commerce.**

Importance of the harbor to the general lake commerce, '89, 2256; '92, 2468.

**Contracts.**

1889. H. M. Loud, for timber and planks, at a total of \$8,220.69; Fletcher, Jenks & Co., for bolts and spikes, at a total of \$1,028.56; E. G. Johnson, for stone, at \$470 per cord, '89, 2257. Detroit Boat Works, for lengthening and repairing steam launch, \$2,835, '90, 2732.

1890. H. D. Edwards & Co., for ship chandlery, at \$189.65; I. Jenks & Co., for coal, at \$375; C. E. Mitchell, for hire of 1 dredge, 1 tug, and 2 dump scows, at \$7.90 per hour; H. M. Loud, for timber (white pine), at \$19.50 per M feet, B. M., '90, 2733.

1891. H. D. Edwards & Co., for ship chandlery, at \$133; J. Jenks & Co., for coal, at \$425, '91, 2779.

1892. J. Jenks & Co., for coal, at \$425, '92, 2467.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 264; '89, 312; '90, 281; '91, 353; '92, 337.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1883-'—. Reports, '88, 1968, 1972; '89, 2254; '90, 2729; '91, 2776; '92, 2464.

**Operations.**

1887-'88. Channel dredging continued, and low superstructure built over unprotected portion of south pier, '88, 1969.

1888-'89. Extensive repairs made to main pier, '89, 2255.

1889-'90. Repairs to main and south piers; reconstruction of steam launch "Sand Beach," '90, 2730.

1890-'91. 6,164 cubic yards material dredged; repairs to piers, '91, 2777.

1891-'92. 25,383 cubic yards material dredged; repairs to main, west, and south piers, '92, 2465.

**Projects.**

By Board of Engineers, 1871, for harbor of refuge formed by a breakwater, composed of a sea and shore arm of an aggregate length of 7,000 feet, and consisting of timber crib work with stone filling, inclosing an area which is to be deepened by dredging where necessary; cost estimated by Board at \$1,452,550, '73, 294; '77, 927; '85, 2156.

In 1877, under the experience of work already done, Maj. Weitzel considered that the project might be accomplished for \$855,000, '77, 927; '86, 1832; '87, 2258.

In 1887, after the appropriation of \$1,050,000, it was estimated that \$130,000 would be required to complete the project, inclusive of repairs, '87, 2257, 2258.

In 1889 Col. Poe estimated the amount required for repairs to existing works, and dredging, at \$230,000, '89, 2256. Increased \$30,000 in 1890, '90, 2731.

**SAN DIEGO HARBOR, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 475.)

**Appropriations.**

1852-'87 .....	\$116, 000
1888.....	1, 000, '88, 2114.
1890.....	60, 500, '90, 2903.
1892.....	50, 000, '92, 2629.

Total ..... 227, 500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 293; '89, 347; '90, 313, 334; '91, 392; '92, 369, 399.

**BOARD OF ENGINEERS.**

Convened at San Francisco, March 14, 1890, to report upon establishment of harbor lines in front of San Diego and Coronado. Reports, '90, 2905; '92, 2640. (Col. Mendell, Lieut. Col. Benyaud, and Maj. Heuer.)

**ENGINEER IN CHARGE.**

Lieut. Col. W. H. H. Benyaud, 1887-'—. Reports, '88, 2114; '89, 2477; '90, 2902, 2904; '91, 2960; '92, 2628.

**Operations.**

1887-'88. No operations, '88, 2114.

1888-'89. Repairs to levee embankments, '89, 2477.

1889-'90. No operations, '90, 2902.

1890-'91. Repairs to levee embankment and dredging in progress at Middle Ground, '91, 2961.

1891-'92. Channel 250 feet wide and 22 feet deep completed through the Middle Ground, '92, 2629.

**Physical Characteristics.**

Description of the harbor entrance and outer bar, '88, 2114.

**Plans.**

By Lieut. Col. Benyaud, 1888, for obtaining a channel 250 feet wide and 24 feet deep at mean low water across the outer bar and from thence to a point abreast of Beacon No. 2, to be secured by dredging and the construction of a stone jetty 7,500 feet in length on Zuniga Shoals; estimated cost, \$394,400, '88, 2116, 2117.

**Projects.**

The project of 1875 proposed the improvement of San Diego Harbor by changing the river back into one of its former outlets in False Bay by cutting a new channel and closing the old one by an embankment, '76, ii, 632. The project was completed in 1877, '77, 999. Subsequent operations confined to repairs to embankments, '86, 1917; '87, 2431; '90, 2902.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Lieut. Col. Benyaud, '88, 2114.

**SANDUSKY CITY HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 475.)

**Appropriations.**

1826-'87 .....	\$280, 480
1888.....	40, 000, '88, 1990.
1890.....	45, 000, '90, 2770.
1892.....	41, 712, '92, 2496.

Total ..... 407, 192

List of appropriations, '92, 2496.

**Contracts.**

1888. C. H. Starke, for dredging, at 17 cents per cubic yard, '89, 2311.

1890. L. P. &amp; J. A. Smith, for dredging, at 18 cents per cubic yard, '91, 2839.

1891. Carlin, Stickney &amp; Cram, for dredging, at 25 cents per cubic yard, '91, 2840.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 271; '89, 322; '90, 291; '91, 366; '92, 346.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1883-'92. Reports, '88, 1988; '89, 2306; '90, 2768; '91, 2837.

Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2495.

**SANDUSKY CITY HARBOR, OHIO—Continued.****Operations.**

1887-'88. Dredging under contract continued, '88, 1989.  
 1888-'89. 75,050 cubic yards material dredged, '89, 2308, 2309.  
 1889-'90. 134,000 cubic yards material dredged, '90, 2769.  
 1890-'91. 67,952 cubic yards material dredged, '91, 2838.  
 1891-'92. 154,510 cubic yards material dredged, '92, 2496.

**Physical Characteristics.**

Description of the locality, '88, 1991.

**Projects.**

From 1884 to 1879, inclusive, \$222,580 was appropriated and expended on the protection of Peninsula Point, and in dredging on the outer and inner bars, '80, 2105, 2109; '87, 2305.

History of operations and projects prior to 1880, '80, 2105.

By Lieut. Col. N. Michler, 1887, extended as to limits of channel 200 feet wide and 15 feet deep through the outer bar and in the bay up to within 50 feet of the dock line and then parallel to the docks, with a width of 100 feet and a depth of 15 feet, '80, 2110; '87, 2302, 2336.

From 1880 to 1886, inclusive, \$67,500 was appropriated and applied upon the project of 1880. In 1887 \$61,000 was estimated as required for completion of the entire project, '87, 2305.

By Maj. Overman, 1888, for the excavation of a straight channel 200 feet wide and 17 feet deep at low water, from the north end of Cedar Point to the east end of the existing channel in front of the city, involving the removal of 538,000 cubic yards of material, at an estimated cost of \$96,712; this, with \$10,000 estimated as required for the completion of the existing channel, makes a total for the project of \$106,712, or, including the appropriation of 1888, of \$66,712 for completion, '88, 1991, 1993.

**Surveys.**

Survey, with a view to a straight channel from the north end of Cedar Point to east end of the existing channel, ordered by act of August 5, 1886. Made, 1887, under direction of Maj. Overman, '88, 1991.

**MAPS.**

'88, 1994; '91, 2839.

**SANDUSKY RIVER, OHIO.—IMPROVEMENT OF**

(Continued from Vol. II, p. 476.)

**Appropriations.**

1887-'82 .....	\$51,500
1890 .....	1,500, '90, 2772.
1892 .....	5,000, '92, 2498.

Total ..... 58,000

List of appropriations, '92, 2498.

**Contracts.**

1890. A. Conché & Co., for dredging, at 25 cents per cubic yard, '90, 2771.

1891. Carlin, Stickney & Cram, for dredging, at 25 cents per cubic yard, '91, 2843.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 271; '89, 323; '90, 292; '91, 366; '92, 347.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1883-'92. Reports, '88, 1996; '89, 2312; '90, 2772; '91, 2840; '92, 2497.

Lieut. Col. J. A. Smith, 1892-'— . Report, '92, 2497.

**Operations.**

1887-'89. No operations, '88, 1996; '89, 2312.

1889-'90. 1,600 cubic yards material dredged from the river, '90, 2771.

1890-'92. Dredging in progress, '91, 2841; '92, 2497.

**Physical Characteristics.**

Description of the locality, '90, 2771.

**Projects.**

From 1867 to 1872, inclusive, \$30,000 was appropriated and expended in formation of a dredged channel through the bars below Fremont, '80, 2112.

By Maj. Wilson, 1880, for improvement of the river by excavation of a channel 100 feet in width and 9 feet in depth through the various bars between the city of Fremont and the 9-foot curve in Sandusky Bay; estimated cost, \$44,000, '81, 2297, 2298; '87, 2306.



**SANDY BAY (ROCKPORT), MASS.—HARBOR OF REFUGE AT.**

(Continued from Vol. II, p. 477.)

**Appropriations.**

1829-'87 .....	\$269, 232. 57
1888.....	100, 000. 00, '88, 441.
1890.....	150, 000. 00, '90, 490.
1892.....	150, 000. 00, '92, 560.

Total ..... 669, 232. 57

**Contracts.**

1888. Boynton Bros., for removing remains of iron spindle, at \$650, '88, 442.  
 1889. Rockport and Pigeon Hill Granite Company, for delivery of rubble stone, at 71 cents per ton, '89, 563.  
 1890. Rockport and Pigeon Hill Granite Company, for delivery of rubble stone, at 73½ cents per ton, '91, 634.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 25; '89, 34; '90, 29; '91, 36; '92, 42.

**BOARD OF ENGINEERS.**

Convened at Boston, Mass., March 2, 1892, by S. O. No. 91, to consider and report upon the location, plan, and estimates for a national harbor of refuge at Sandy Bay. Report, '92, 560. (Col. Craighill, Lieut. Col. Mansfield, and Maj. Raymond.)

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 439.

Lieut. Col. S. M. Mansfield, 1889'—. Reports, '89, 561; '90, 488; '91, 632; '92, 558.

**Operations.**

1887-'88. 83,935 tons rubble stone deposited upon the breakwater; hole drilled and new spindle placed, '88, 439.

1888-'89. 41,965 tons rubble stone deposited in the breakwater, '89, 562.

1889-'90. 68,035 tons rubble stone deposited in the breakwater, '90, 490.

1890-'91. 54,239 tons of rubble stone deposited in the breakwater, '91, 634.

1891-'92. 108,515 tons of rubble stone deposited in the breakwater, '92, 557.

**Projects.**

The project of Maj. Raymond, of 1884, contemplated the construction of a "national harbor of refuge of the first class" at Sandy Bay, Mass. The project as approved by the Board of Engineers of 1884 was for a breakwater about 9,000 feet long, starting at Averys Ledge and running to Abners Ledge; thence in a northwesterly direction to the 26-foot curve of depth off Andrews Point; the breakwater to be formed to the level of 22 feet below low water of random stone, and with a width at top of 40 feet, above which will be built a masonry wall whose top will be 15 feet wide and carried 8 feet above high water. The details of the masonry construction were not definitely adopted. The estimated cost of the work was about \$5,000,000, with \$2,500,000 for buoyage, lighting, and defense, '84, 567, 570; '85, 229; '86, 67, 581, 582; '87, 24, 497, 498.

In 1885 Maj. Raymond proposed the construction of a pier upon Averys Ledge to define its locality and to form one end of a future breakwater, '86, 581.

In 1892 the Board of Engineers proposed the construction of both substructure and superstructure of rubble stone, and estimated \$5,000,000 as required for completion, '92, 560.

**Surveys.****MAPS.**

'88, 440; '92, Atlas, 3.

**SANDY HOOK BAR.—(See NEW YORK HARBOR.)****SAN FRANCISCO HARBOR AND INTERIOR BAYS.—SURVEY OF.**

(Continued from Vol. II, p. 478.)

**Appropriations.**

1886..... \$11, 000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 291; '89, 347; '90, 311, 334; '91, 389.

**SAN FRANCISCO HARBOR AND INTERIOR BAYS—Continued.****Engineers—Continued.****BOARD OF ENGINEERS.**

Convened at San Francisco, March 11, 1890, by S. O. No. 51, to report upon establishment of harbor lines in San Francisco Harbor and adjacent waters. Report, '90, 2890. (Col. Mendell, Lieut. Col. Benyaard, and Maj. Heuer.)

Convened at San Francisco, June 8, 1891, by S. O. No. 51, to report upon the establishment of harbor lines for San Francisco Harbor and adjacent waters. Report, '91, 2948. (Col. Mendell, Lieut. Col. Benyaard, and Maj. Heuer.)

**ENGINEERS IN CHARGE.**

Col. G. H. Mendell, 1887-'89. Reports, '88, 2108; '90, 2890; '91, 2947, 2948.

Maj. W. H. H. Benyaard, 1889-'90. Report, '89, 2478.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Col. Mendell, '88, 2108; '89, 2478; '90, 2890.

**SAN JOAQUIN RIVER, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 479.)

**Appropriations.**

1876-'87 .....	\$158, 750
1888.....	25, 000, '88, 2131. •
1890.....	75, 000, '90, 2911.
1892.....	65, 000, '92, 2650.

Total ..... 323, 750

List of appropriations, '92, 2646.

**Contracts.**

1891. C. L. Bigelow, for pile and brush dam construction, at \$5,013, '91, 2983. J. W. Ferris, for reconstruction of submerged dam, at \$18,800, '91, 2984.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 293; '89, 348; '90, 313; '91, 394; '92, 370.

**ENGINEER IN CHARGE.**

Maj. W. H. Heuer, 1888-'—. Reports, '88, 2129; '89, 2484; '90, 2909; '91, 2981; '92, 2645.

**Operations.**

1887-'88. 144,975 cubic yards material dredged from Stockton Slough by hired labor, '88, 2130.

1888-'89. 82,150 cubic yards material dredged from Stockton Slough by hired labor; dam built by contract for partial closure of Paradise Cut, '89, 2484.

1889-'90. 120,960 cubic yards material dredged from Stockton Slough by hired labor, '90, 2910.

1890-'91. 138,242 cubic yards material dredged from Stockton Slough, '91, 2982.

1891-'92. Dam completed across Lairds Slough under contract, '92, 2647. Brush and pile dam completed across Paradise Cut, '92, 2648. 226,932 cubic yards material dredged, '92, 2649.

**Projects.**

The general project under which work has been carried on has for its object the improvement of the San Joaquin River by removal of snags and points of land, excavation of cut-offs, and dredging Stockton Channel, '75, ii, 729; '78, 1302. Also maintenance, by dredging, of a 9-foot low-water channel 100 feet wide through tidal parts of the river below Stockton, a 4-foot low-water channel 80 feet wide, Mormons Slough to Miller's Warehouse, and temporary improvements in the low-water channels of upper river to Hills Ferry, '81, 2476; '86, 1921.

In 1887 it was estimated that \$139,000 would be required for the improvement of Paradise Cut and cut-offs, '87, 2439; '90, 2909.

In 1891 it was proposed to maintain a 9-foot depth up to Stockton to form a cut-off at Twenty Mile Slough, to increase the cut at Head Reach, and to remove snags and construct wing dams, at a total cost to complete of \$136,750, '91, 2985.

**SAN LUIS OBISPO, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 480.)

**Appropriations.**

1888.....	\$25, 000, '88, 292.
1890.....	40, 000, '90, 2900.
1892.....	30, 000, '92, 2625.

Total ..... 95, 000

**Contracts.**

1888. R. Axman, for furnishing and placing stone in breakwater, at \$3.44 per ton, '89, 2474.  
 1890. San Francisco Bridge Company, for breakwater construction, at \$3.38 per ton, '91, 2956.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 292, 293; '89, 346; '90, 311; '91, 391; '92, 368.

**ENGINEER IN CHARGE.**

Lieut. Col. W. H. H. Benyaard, 1887-'—. Reports, '89, 2473; '90, 2899; '91, 2955; '92, 2624.

**Operations.**

- 1887-'88. No operations, '88, 292.  
 1888-'89. 2,812 tons rock deposited in the breakwater, '89, 2473.  
 1889-'90. 3,784 tons rock deposited in the breakwater, '90, 2899.  
 1890-'91. No operations, '91, 2955.  
 1891-'92. 7,870 tons of rock placed in the breakwater, '92, 2624.

**Projects.**

By Lieut. Col. Benyaard, 1887, for the construction of a stone breakwater, about 2,300 feet in length, along the sunken reef near Whalers Island, extending from Point San Luis to Whalers Island and thence to a point where the outer reef rises above high water; the purpose of the breakwater is to afford a protected anchorage and landing at Port Harford; estimated cost, \$284,898, '87, 2434, 2435; '90, 2899.

**SAN PEDRO AND SANTA MONICA BAYS, CAL.—SURVEY FOR DEEP-WATER HARBOR OF REFUGE.**

(Continued from Vol. II, p. 481.)

**Appropriations.**

1890.....	\$5, 000
1892.....	10, 000

Total ..... 15, 000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 293; '91, 426; '92, 370, 399.

**BOARD OF ENGINEERS.**

Convened at San Francisco, December 8, 1891, to determine upon the location for a deep-water harbor on the Pacific coast. Report, '92, 2631. (Col. Mendell and Lieut. Cols. Gillespie and Benyaard.)

Convened at San Francisco, July 8, 1892, by S. O. No. 20, to report upon the establishment of harbor lines at San Pedro, Wilmington Harbor. Reports, '91, 2976; '92, 2638. (Col. Mendell, Lieut. Col. Benyaard, and Maj. Heuer.)

**ENGINEER IN CHARGE.**

Lieut. Col. W. H. H. Benyaard, 1886-'—. Reports, '88, 2122; '92, 2630.

**Physical Characteristics.**

Description of the locality, '88, 2124; '92, 2631.

**Plans.**

By Maj. Benyaard, 1888, for improvement of San Pedro Bay by affording a protected anchorage ground through the construction of a westerly stone breakwater 3,300 feet in length, and an easterly one 2,500 feet in length; estimated cost, \$4,045,700, '88, 2125.

By Board of Engineers, 1891, for the formation of a deep-water harbor at San Pedro by construction of a rubble and concrete breakwater, at a cost of \$4,594,494, or one entirely of rubble stone, at a cost of \$4,137,591, '92, 2636. (Col. Mendell and Lieut. Cols. Gillespie and Benyaard.)

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Maj. Benyaard, '88, 2124.

**SAN RAFAEL RIVER, CAL.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 393.

ENGINEER IN CHARGE.

Lieut. Col. W. H. H. Benyaurd, 1891. Report, '91, 2963.

**Physical Characteristics.**

Description of the locality, '91, 2963.

**Plans.**

In 1890 Lieut. Col. Benyaurd did not consider the locality worthy of improvement, '91, 2963.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Benyaurd, '91, 2963.

**SAN SIMEON BAY, CAL.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 348; '91, 393.

ENGINEER IN CHARGE.

Maj. W. H. H. Benyaurd, 1888. Reports, '89, 2480; '91, 2971.

**Plans.**

After examination in 1888 and also in 1890 Lieut. Col. Benyaurd did not consider the locality worthy of improvement, '89, 2480; '91, 2971.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Benyaurd, '89, 2480.

**SANTA CRUZ, CAL.—EXAMINATION FOR HARBOR OF REFUGE AT.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 393, 2968.

ENGINEER IN CHARGE.

Lieut. Col. W. H. H. Benyaurd, 1891. Report, '91, 2968.

**Physical Characteristics.**

Description of the locality, '91, 2968.

**Plans.**

In 1890 Lieut. Col. Benyaurd did not consider the establishment of a harbor of refuge at this point desirable in view of the cost of such an improvement compared with the commercial interests to be benefited, '91, 2970.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Benyaurd, '91, 2971.

**SANTEE RIVER, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 481.)

**Appropriations.**

1881-'86 .....	\$75, 750
1888 .....	24, 000, '88, 936.
1890 .....	30, 000, '90, 1220.
1892 .....	30, 000, '92, 1212.

Total ..... 159, 750

List of appropriations, '90, 1219.

**Commerce.**

Importance of, '88, 938.

Effect of improvement upon timber trade, '89, 1188.

**Contracts.**

1888. C. C. Ely, for dredging, at from 35 to 40 cents per cubic yard, '89, 1187.

1890. L. S. Ehrich, for dredging, at 37½ cents per cubic yard, '91, 1459.

**SANTEE RIVER, S. C.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 131; '89, 154; '90, 138; '91, 173; '92, 172.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'89. Report, '88, 933.

Capt. F. V. Abbot, 1889-'— . Reports, '89, 1182; '90, 1218; '91, 1458; '92, 1211.

**ASSISTANT.**

R. Whitford. Reports, '88, 936; '89, 1187; '90, 1220; '91, 1460.

**Operations.**

1887-'88. 142 linear feet of U. S. canal banks raised, '88, 935.

1888-'89. 1,346 cubic yards material dredged, '89, 1187.

1889-'90. 47,792 cubic yards material dredged, '90, 1220.

1890-'91. 140 snags and 6,477 cubic yards of material removed from the channel, and 141 trees cleared from the banks, '91, 1460.

1891-'92. 6,299 cubic yards material dredged, '92, 1212.

**Projects.**

The original project of 1880 for this river proposed to provide a good outlet through Mosquito Creek to Winyaw Bay, by deepening and straightening this creek to 50 feet width and 7 feet depth, and to secure a safe and unobstructed 7-foot navigation in the river itself from its mouth 154 miles up, and to Wrights Bluff, and thence a similar 5-foot navigation 30 miles farther to its head in the Congaree and Wateree rivers. A modified project of 1881 proposed that the first expenditures should be to secure a straightened outlet through Mosquito Creek 7 miles long, 30 feet wide, and 6 feet deep at low water. In 1885 Congress prescribed a reserve of \$5,000 for the construction of a flood gate, if found necessary, to keep out salt water at the upper end of the canal. The total final cost of this work was estimated in 1886 at \$271,300 for the outlet through Mosquito Creek, and \$75,000 for the Santee River proper, making \$346,500 in all. Aggregate amount appropriated to June 30, 1889, \$99,750, '89, 1183.

The revised project of 1889 provided for leaving the Mosquito Creek Canal, which has been completed, 30 feet wide and 3 feet deep, for a timber route; cutting a new canal between Estherville and Minim Creek large enough for river steamers, and snagging the entire river, at an estimated cost of \$350,000, '92, 1211.

**Surveys.****MAPS.**

'89, 1186; '90, 1220.

**SARANAC RIVER, N. Y.—EXAMINATION FOR HARBOR OF REFUGE, INNER BAY.**

(See also PLATTSBURG, N. Y.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 388, 2938.

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1890. Report, '91, 2939.

**Plans.**

In 1890 Maj. Adams did not consider the locality worthy of improvement, '91, 2939.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Adams, '91, 2939.

**SARASOTA BAY, FLA.—IMPROVEMENT OF.****Appropriations.**

1890..... \$5,000, '91, 1652.

1892..... 2,500, '92, 1383.

Total ..... 7,500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 175; '90, 156; '91, 191; '92, 188.

**SARASOTA BAY, FLA.—Continued.****Engineers—Continued.****ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1888-'92. Reports, '90, 1615; '91, 1651.

Maj. J. C. Mallory, 1892-'— Report, '92, 1382.

**ASSISTANTS.**

D. B. Dunn. Report, '90, 1616.

J. H. Bacon. Report, '90, 1618.

**Operations.**

1891-'92. 4,363 cubic yards material dredged, '92, 1383.

**Physical Characteristics.**

Description of the locality, '90, 1617; '91, 1651.

**Plans.**

By Capt. Black, 1889, for excavation of a channel 5 feet deep and 100 feet wide through Sarasota Bay from Tampa Bay to Sarasota, and 3 feet deep and 75 feet wide from Sarasota to Caseys Pass; estimated cost, \$37,000, '90, 1618.

**Projects.**

By Capt. Black, 1891, for the formation of a channel 5 feet deep at mean low water and 100 feet wide from Tampa Bay to Sarasota; estimated cost, \$10,000, '91, 1651.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Black, '90, 1617.

**SASSAFRAS RIVER, MD.—EXAMINATION OF.**

(Continued from Vol. II, p. 482.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 112.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1888. Report, '89, 924.

**ASSISTANT.**

A. Stierle. Report, '89, 925.

**Physical Characteristics.**

Description of the locality, '89, 925.

**Plans.**

By Mr. W. F. Smith, 1889, for the excavation of an 8-foot channel 100 feet in width from the mouth up to Fox Hole Wharf, a distance of about 5,000 feet; also excavation of a turning basin; estimated cost, \$18,000, '89, 926.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Mr. W. F. Smith. '89, 924.

**SAUGATUCK HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 482.)

**Appropriations.**

1868-'87 .....	\$135,439.00
1888.....	5,000.00, '88, 1915.
1891.....	* 1,917.37, '91, 2699.
1892.....	5,000.00, '92, 2353.

Total ..... 147,356.37

List of appropriations, '92, 2352.

**Commerce.**

Present and future commercial prospects of Saugatuck, '89, 2203, 2204.

**Contracts.**

1889. Geer & Crawford, for white pine timber, at \$18.85 per M feet, B. M.; Parkhurst & Wilkinson, for drift bolts, at 2 cents per pound, '89, 2190.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 256; '89, 302, 306; '90, 271; '91, 342; '92, 328.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1914.

Maj. W. Ludlow, 1889-'—. Reports, '89, 2189, 2202; '90, 2654; '91, 2699; '92, 2350.

\* Received from sale of materials to Manistee Harbor, '91, 2699.

**SAUGATUCK HARBOR, MICH.—Continued.****Operations.**

1887-'88. Superstructure reconstruction by hired labor completed, '88, 1915.

1888-'89. No operations, '89, 2190.

1889-'90. 25,594 cubic yards material dredged, '90, 2655.

1890-'91. 6,615 cubic yards material dredged, '91, 2699.

1891-'92. No operations, '92, 2352.

**Physical Characteristics.**

Description of the locality, '89, 2189.

**Plans.**

Maj. Ludlow reported, after an examination in 1888, that the harbor was not worthy of improvement to the extent of obtaining a channel of navigable width, with a minimum depth of 15 feet, and reconstructing piers, as recommended by the Board of Engineers, '89, 2204.

**Private and Corporate Work.**

Attempt by citizens of Saugatuck to scour through bar at channel mouth, '90, 2655.

**Projects.**

Prior to the adoption of the existing project in 1869, a well-constructed slab pier had been built by private enterprise, '67, 130; '69, 190; '74, i, 190; '76, ii, 509.

The project of 1869 provided for the extension of two parallel piers about 220 feet apart, connecting the Kalamazoo River with Lake Michigan, so as to provide a channel entrance of navigable width at 10 feet depth, '69, 100, 101; '74, i, 190; '76, ii, 507, 510.

The recommendations of the Board of Engineers of 1875 provided for the extensive repair of revetment already built, '75, i, 258; '76, ii, 509; '87, 2196; '91, 2699.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Ludlow, '89, 2202.

**SAUGERTIES HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 483.)

**Appropriations.**

1884-'87 .....	\$20,000
1888 .....	12,000, '88, 595.
1890 .....	10,000, '90, 701.
1892 .....	5,000, '92, 772.

Total .....

47,000

List of appropriations, '88, 595.

**Contracts.**

1888. H. Du Bois' Sons, for pile dike construction, at \$6.79 per linear foot, '88, 596.

1889. P. W. Myers, for dredging, at 15½ cents per cubic yard; Wm. Parrott, for dike construction, at \$8.25 per linear foot, '89, 762.

1890. Wm. Parrott, for dike construction, at a total of \$7,746, '91, 882.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 58; '89, 72; '90, 64; '91, 82; '92, 86.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. McFarland, 1888-'89. Report, '88, 594.

Lieut. Col. G. L. Gillespie, 1889-'— . Reports, '89, 761; '90, 699; '91, 879; '92, 771.

**Operations.**

1887-'88. 2,363 linear feet of pile dike built, '88, 595.

1888-'89. 22,646 cubic yards material dredged, '89, 762.

1889-'90. 28,746 cubic yards material dredged; work continued upon pile and crib dikes, '90, 700.

1890-'91. Extension of north dike in progress, '91, 880.

1891-'92. Extension of north dike completed, '92, 772.

**Physical Characteristics.**

Description of the harbor, '88, 594.

**Projects.**

By Lieut. Col. McFarland, 1887, for the formation of a channel 300 feet wide and 8 feet deep at mean low water, by the construction of parallel dikes 2,300 feet long, with dredging in the channel between the dikes if necessary; estimated cost, \$52,000, '87, 662; '92, 771.

**SAUK RAPIDS, MINN.—(See MISSISSIPPI RIVER ABOVE FALLS OF SAINT ANTHONY.)****SAVANNAH RIVER above Augusta, Ga.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 484.)

**Appropriations.**

1880-'82 .....	\$39,000
1892 .....	10,000

Total .....	49,000
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List of appropriations, '88, 1032.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 140; '89, 160, 164; '90, 143, 147.

**ENGINEER IN CHARGE.**

Lient. O. M. Carter, 1888-'—. Reports, '88, 1031; '89, 1241; '90, 1365, 1484.

**ASSISTANTS.**

W. R. Curtis. Report, '88, 1032.

G. W. Brown. Report, '90, 1498, 1526.

**Operations.**

1887-'88. No operations since 1883, '88, 1031; '89, 1242; '90, 1366.

**Plans.**

By Lient. Carter, 1890, for the formation, between Petersburg and The Locks, of a downstream channel 12 to 25 feet in width and navigable nine months of the year for pole boats of 2 feet draft; also for an upstream channel, navigable under the same conditions, for boats drawing 1.3 feet; estimated cost, \$33,000, '90, 1525, 1526.

**Projects.**

By Col. Gillmore, 1879, for improvement of Savannah River from Augusta to head of pole-boat navigation on the Tugaloo, a distance of 154 miles, by formation of a 3-foot channel 30 feet wide from Augusta to Trotters Shoal, 64 miles, and removal of rocks, snags, and similar obstructions for the remaining distance; estimated cost, \$45,000, '80, 958, 959; '87, 1172.

By Lient. Carter, 1890, for establishing, between Petersburg and The Locks, a downstream channel 12 to 25 feet wide and navigable during ordinary summer low water for pole boats drawing 2 feet, and for an upstream channel, navigable under the same conditions, for pole boats drawing 1.3 feet of water; this to be obtained by removal of logs and overhanging trees, excavation of rock, sand, and gravel, and construction of training walls to increase the flow of water through the sluices; estimated cost, \$33,000, '90, 1366.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Lient. Carter, '90, 1525.

**SAVANNAH RIVER between Savannah and Augusta, Ga.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 484.)

**Appropriations.**

1881-'87 .....	\$70,000
1888 .....	21,000, '88, 1029.
1890 .....	25,000, '90, 1327.
1892 .....	35,000, '92, 1256.

Total .....	151,000
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List of appropriations, '88, 1028.

**Commerce.**

Increase in commerce and saving in freight rates due to improvement, '88, 1028.

Rail and mill freight rates on cotton from 1885 to 1890, '91, 1523.

Commerce and navigation, '92, 1255.



**SAVANNAH RIVER between Savannah and Augusta, Ga.—Continued.****Contracts.**

1888. M. A. Sweeny & Bro., for repairing snag boat, at \$10,400, '89, 1241.  
 1889. W. T. Gaynor, for riprap stone, at \$2 per cubic yard, and for fascines, at 70 cents per cubic yard, '90, 1327.  
 1891. J. F. Gaynor, for construction and repair of wing dams and shore protection, at \$1.29 per cubic yard for mattress and \$2.69 per cubic yard for stone, '92, 1256.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 139; '89, 159; '90, 142; '91, 180; '92, 176.

**ENGINEER IN CHARGE.**

Lieut. O. M. Carter, 1888—'. Reports, '88, 1026; '89, 1237; '90, 1324, 1328; '91, 1519; '92, 1253.

**ASSISTANTS.**

W. R. Curtis. Report, '88, 1029.

G. W. Brown. Report, '90, 1322.

F. C. Armstrong. Reports, '90, 1363; '91, 1525; '92, 1257.

**Operations.**

1887-'89. No operations, '88, 1028; '89, 1239.

1889-'90. 244 snags and stumps removed from the channel, and 120 trees from the bank; 4,572 cubic yards fascines and 1,158 cubic yards stone placed in spur dams, '90, 1326.

1890-'91. 353 snags removed from the channel, and 3,443 overhanging trees cleared from the banks, '91, 1521.

1891-'92. 2,179 cubic yards brush fascines and 1,382 cubic yards of stone used in construction of spur dams, and 2,682 cubic yards of brush fascines and 1,969 cubic yards of stone used in repairs to old work, '92, 1254.

**Physical Characteristics.**

Description of the river, '88, 1026; '89, 1237; '90, 1328.

**Projects.**

By Col. Gillmore, 1880, for securing a 5-foot low-water channel between Savannah and Augusta by dredging, contraction of river, bank protection, and the removal of logs, snags, and similar obstructions; estimated cost, \$91,000, '80, 1094; '86, 1098; '87, 1166.

By Lieut. Carter, 1890, for the establishment of a navigable 5-foot steamboat channel at ordinary summer low water between Augusta and Savannah; this to be accomplished by removal of sand bars, regulating portions of the river, revetting caving banks, closing incipient cut-offs, and removing snags and logs from the channel and overhanging trees from the banks of the stream; estimated cost, \$332,000, '90, 1324, 1329, 1330; '92, 1253.

**Surveys.**

Of the river between Savannah and Augusta. Made, 1870, '90, 1328, 1332.

**MAPS.**

'90, 1362.

**SAVANNAH RIVER at and below Savannah, Ga.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 485.)

**Appropriations.**

1826-'87 .....	\$1, 674, 606. 64
1888 .....	180, 000. 00, '88, 1012.
1890 .....	350, 000. 00, '90, 1253.
1892 .....	318, 750. 00

Total .....

2, 523, 356. 64

List of appropriations, '88, 1012; '89, 1227.

**Commerce.**

Increase consequent upon improvement, '88, 1011.

Effect of past improvements upon commerce and navigation, '89, 1225; '90, 1251, 1252.

**Contracts.**

1888. P. S. Ross, for dredging, at 18½ cents per cubic yard, '89, 1228.

1889. William T. Gaynor, for training-wall construction, at \$3.19 per cubic yard for stone, \$1.29 per cubic yard for oyster shells, and 63 cents per square yard for mattress work, '89, 1228.

**SAVANNAH RIVER at and below Savannah, Ga.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 138, 143; '89, 158, 164, 367, 1286, 1287, 1291; '90, 142, 1258.

**BOARD OF ENGINEERS.**

Convened at Washington, November 10, 1888, by S. O. No. 50, to examine and report upon project by Lieut. Carter for improvement of the Savannah River from the dam at Cross Tides to the sea. Report, '89, 1236. (Lieut. Cols. Gillespie and King and Maj. Post.)

Convened at Savannah, April 1, 1889, by S. O. No. 13, to establish the harbor lines of Savannah Harbor. Report, '89, 1289. (Col. Craighill, Capt. Birby, and Lieut. Carter.)

**ENGINEERS IN CHARGE.**

Col. Q. A. Gillmore, 1872-'88. Report, '88, 1057, 1059.

Capt. O. M. Carter, 1888-'—. Reports, '88, 1005, 1012; '89, 1220, 1234, 1282, 1285; '90, 1245, 1259; '91, 1491, 1506; '92, 1243.

**ASSISTANTS.**

Lieut. O. M. Carter. Report, '88, 1058, 1063.

A. S. Cooper. Reports, '89, 1228; '90, 1253.

E. A. Giesler. Reports, '89, 1231; '90, 1265, 1298.

**Operations.**

History of past work, '88, 1012, 1063.

1887-'88. 818 cubic yards brush fascines and 429 cubic yards stone placed in the training walls, '88, 1009.

1888-'89. 8,108 cubic yards stone and 92,922 square yards mattress placed in training wall; 187,671 cubic yards material dredged, '89, 1230.

1889-'90. 3,924 cubic yards riprap stone, 310 cubic yards of shells, 495 cubic yards of brush fascines, and 17,666 square yards log and brush mattress placed in Fig Island and Oyster Bed training wall; 31,551 cubic yards material dredged, '90, 1249, 1250.

1890-'91. 72,178 square yards of log and brush mattress and 26,160 cubic yards of riprap stone used in construction of 1,984 linear feet of training wall; 1,245 linear feet of brush and pile spur dam built at Elba and Jones islands; 532 linear feet of pile, brush, and stone closing dam built at Duck Puddle; 933 piles and 7,492 cubic yards of stone used in southern Elba Island training wall; 396,144 cubic yards of material dredged from the channels at ocean steamship wharves, Garden Bank, Wrecks Channel, Upper Flats, and Tybee Knoll, '91, 1495.

1891-'92. 683 cubic yards of stone placed upon crest of Oyster Bed training wall; 6,818 cubic yards of brush and 680 cubic yards of stone used in completion of Elba and Jones Island spur dams; 35,506 cubic yards of material dredged from the channel at Tybee Knoll, '92, 1247.

**Physical Characteristics.**

Description of the river, '88, 1063.

Table of wind directions and velocities from 1871 to 1886, '88, 1067.

Tides, duration of, '88, 1067.

Physical elements of Front River and North Channel, 1890, '91, 1509.

**Projects.**

From 1826 to 1873, inclusive, \$449,473.68 was appropriated, including relief claims, and applied to closing channel between Hutchinson and Argyle islands and Fig Island, deepening channel over the wrecks, removing obstructions, and in dredging, '73, 734, 737.

By Col. Gillmore, 1873, for formation of a channel from Tybee Roads to Savannah City, with a high-water depth of 22 feet, to be accomplished by construction of a crib dam closing the Cross Tides and a short bulkhead on Hutchinsons Island; widening the waterway at the city front and Fig Island, and by deepening, widening, and strengthening the channel, by dredging, at various points between the city and Tybee Roads; estimated cost, \$481,320, '73, 741, 747; '80, 933; '82, 1142.

Project modified in 1879 by a supplementary plan for the improvement of the north channel of the river from the head of Elba Island to the head of Long Island by a low dam across the upper end of the south channel and by dams closing lateral channels and providing shore protection where necessary, '80, 948, 957.

Board of Engineers of 1879 recommended approval of project, '80, 947.

The estimated cost of supplementary project covered by estimate for project of 1879, '80, 947; '82, 1143.

From 1874 to 1881, inclusive, \$714,132.96 was appropriated on the projects of 1873 and 1879, '82, 1145.

**SAVANNAH RIVER at and below Savannah, Ga.—Continued.****Projects—Continued.**

The project of 1882 comprised those of 1873-79 and provided for additional works with a view to rendering the improvement permanent by raising the dam at Cross Tides to ordinary high water; for dredging in reach of Front River from Cross Tides to city; increasing width of channel opposite city to 600 and 650 feet; construction of training wall at Fig Island; elevation of south channel dam; the improvement of shallow reaches between Jones and Elba islands by construction of spur jetties and wing dams; closing, by dams, the cross channels between Elba and Cocks Pen Island; construction of jetty from Jones Island, Red Light Beacon, and for protection of Saint Michaels Channel by similar work; also shore protection and dredging; estimated cost, \$730,000, '82, 1143, 1144, 1145; '84, 1099; '86, 1087; '87, 1150.

The project under which operations were conducted from 1887 to 1889 was submitted by Col. Gillmore in 1887, and provided for a depth of 28 feet from the city of Savannah to the sea. The principal features of the project were (1) to enlarge Drakes Cut to a width of 200 feet; (2) to enlarge the channel south of Kings Island to 400 feet width, and to close the Cross Tides; (3) to build a training wall from the lower end of Marsh Island to Kinzeys Point, to enlarge the river at the city to a width of 600 feet by cutting off a part of Hutchinsons Island, and to connect the ends of the Garden Bank wing dams by a training wall extending from the old dry dock to a point above Fig Island Light; (4) to close the South Channel below the mouth of Saint Augustine Creek; (5) to connect the ends of the wing dams between the head of Elba Island and the Oyster Beds by training walls, extending about 3 miles eastward from the Oyster Beds, for the improvement of the channel across Tybee Knoll; (6) to construct a detached breakwater, rising to 2 feet above mean high water and extending from shoal water between the mouths of Calibogue Sound and New River in a southeasterly direction to deep water across the bar; to construct a south jetty, extending from the north end of Tybee Island in a northeasterly direction to deep water across the bar, this jetty to be at high water at its inner end, sloping down to half tide at 500 feet out and retaining that height to the inner 18-foot curve of the bar; beyond that point to be an apron course only, width between the jetties at outer 21-foot curve to be about 2,500 feet, at the inner 18-foot curve about 5,500 feet; (7) to dredge a channel at least 300 feet wide and 28 feet deep at mean high water from the city to the sea, the dredged material to be deposited on banks or behind training walls; (8) to construct stone protection at various points; estimated cost, \$6,660,000, '88, 1006, 1007.

In 1890 operations were continued under a revised project submitted by Lieut. Carter, providing for a channel depth of 26 feet at mean high water from the city to the sea, this to be secured by the following operations: The enlargement of Drakes Cut as indicated in the original project; the entire or partial removal of Kings Island with a view to turning additional volumes into Front River and thereby somewhat increasing the velocities; the construction of a deflecting jetty from Argyle Island; the partial removal of Marsh Island and closing up the channel north of it, with a view to throwing the entire flow into the enlarged southern channel and thus doing away with the disadvantages incident upon two channels; a training wall from the lower end of Marsh Island to Kinzeys Point, and the widening of the unduly contracted region below Kinzeys Point; a training wall in the vicinity of Garden Bank in order to properly contract the river there; spur jetties or bank protection in the lower portion of Wrecks Channel for the same purpose; dredging a channel 26 feet deep at mean high water from the city waterworks to the sea; a deflecting jetty running out toward South Channel from Mackeys Point in order to divert a greater ebb volume into North Channel; the removal of a portion of Dam 15; the closing of Duck Puddle in order to render permanent the improvement of North Channel near the lower mouth of Duck Puddle; the construction of training walls and shore protection in the concave bend near Spirit Island, between wing dams in North Channel, and between Lower Flats and Oyster Beds, with a view of obtaining a strong ebb flow of uniform mean velocity throughout; dredging south of Oyster Bed with a view to obtaining cross-sectional areas of about 45,000 square feet for mean ebb outflow, in order to induce a stronger flow through the southern opening and thence over Tybee Knoll; estimated cost of this improvement, \$3,500,000, '90, 1261, 1263; '91, 1492; '92, 1244.

**Surveys.**

Examinations ordered by act of August 5, 1886. Made, 1886, under direction of Col. Gillmore, '88, 1067.

**SAVANNAH RIVER at and below Savannah, Ga.—Continued.****Surveys—Continued.**

Survey ordered by act of August 5, 1886. Made, 1887, under direction of Col. Gillmore, '88, 1059.

Hydrographic survey of Savannah River from Cross Tides to the sea, '90, 1263.

Survey to determine whether the damage to the Vernezobie Freshet Bank in 1887 was caused by the work at Cross Tides, and whether the maintenance of said bank is essential to the success of the work at Cross Tides, and to determine the cost of so constructing said bank as to confine the water of said river to its bed, ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Carter.

**MAPS.**

'88, 1012, 1072; '89, 1226, 1284; '90, 1302. '92, Atlas, 49, 50, 51, 52, 53, 54, 55, 56, 57.

**SAVANNAH, GA., AND FERNANDINA, FLA.—SURVEY FOR INSIDE ROUTE BETWEEN.****Appropriations.**

1892..... \$15,000

**Commerce.**

Commercial interests to be affected by the improvement, '92, 1323.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '92, 181.

ENGINEER IN CHARGE.

Capt. O. M. Carter, 1891. Report, '92, 1309, 1311.

**Physical Characteristics.**

Description of the locality, '92, 1311.

**Plans.**

By Capt. Carter, 1891, to establish a continuous channel not less than 7 feet deep at mean low water between Savannah, Ga., and Fernandina, Fla., by dredging, bank revetment, and spur-dam construction at Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek; estimated cost, including annual cost of maintenance after completion of the Romerly Marsh and Mud River improvements, \$195,000, '92, 1323.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Carter, '92, 1311.

**SAYBROOK BAR, mouth of Connecticut River.—(See CONNECTICUT RIVER.)****SCHUYLKILL RIVER, PA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 487.)

**Appropriations.**

1870-'87 .....	\$368,750
1888.....	25,000, '88, 701.
1890.....	45,000, '90, 886.
1892.....	46,250, '92, 925.

Total..... 485,000

List of appropriations, '90, 885.

**Commerce.**

Commercial interests and requirements, '88, 700; '90, 885.

**Contracts.**

1888. American Dredging Company, for dredging, at 19 cents per cubic yard, '89, 866.

1891. F. C. Somers, for dredging, at 18.9 cents per cubic yard, '91, 1071.

1892. F. C. Somers, for earth dike construction, at 7.4 cents per cubic yard, '92, 925. B. G. Bailey, for pile dike construction, at \$15.87 per linear foot, and earth filling, at 10 cents per cubic yard, '92, 925.

8648—27

**SCHUYLKILL RIVER, PA.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 78; '89, 97; '90, 87; '91, 112; '92, 113.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1885-'89. Reports, '88, 699; '89, 864.

Maj. C. W. Raymond, 1889-'— . Reports, '90, 884; '91, 1069; '92, 923.

**Operations.**

1887-'88. No operations for lack of funds, '88, 699.

1888-'89. 111,354 cubic yards material dredged, '89, 864.

1889-'90. No operations, '90, 884.

1890-'91. 95,890 cubic yards of material dredged, '91, 1069.

1891-'92. 400 cubic yards of hard material dredged, '92, 923.

**Projects.**

By Col. Kurtz, 1870, for the formation of a dredged channel 100 feet wide and 20 feet deep from the mouth to Gibsons Point; thence 18 feet deep to Chestnut Street Bridge in the city of Philadelphia; estimated cost, \$257,700, '74, ii, 139, 140. Modified in 1875 to provide for a channel 300 feet wide and 24 feet deep between the mouth and Girard Point, '75, ii, 187; '76, i, 272; '79, 264.

Further modification in 1883 to increase the width of channel between the mouth and Girard Point to 400 feet, with a depth of 24 feet, and from Girard and Gibsons points a width of 250 feet and a depth of 20 feet at mean low water, '83, 614; '87, 78.

From 1870 to 1886, inclusive, \$368,750 was appropriated, when it was estimated that \$116,250 would be required to complete the project, '87, 801.

The present project proposes the formation of a channel 400 feet wide and 24 feet deep at mean low water from the mouth of the river to Girard Point, a distance of about 1 mile; from thence to Gibsons Point, a further distance of about 3 miles, a channel 20 feet deep and 250 feet wide, except at Yankees Point, where the channel width was to be increased to 300 feet; from thence to Chestnut Street Bridge in Philadelphia, a distance of about 3 miles, a channel of navigable width and 18 feet deep at mean low water; the proposed channels to be obtained by dredging, at an estimated cost of \$485,000, of which amount \$438,750 has been appropriated, '91, 1069.

By Maj. Raymond, 1892, for preservation of the channel at the mouth of the Schuylkill by construction of 2,910 linear feet of earthen and 1,800 linear feet of pile dike, at an estimated cost of \$44,209, '92, 929.

**Surveys.****MAPS.**

'88, 700; '92, Atlas, 10.

**SCITUATE HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 488.)

**Appropriations.**

1829-'87 .....	\$48,680
1888 .....	5,000, '88, 459.
1890 .....	10,000, '90, 509.
1892 .....	10,000, '92, 588.

Total ..... 73,680

**Contracts.**

1888. Boynton Bros., for dredging, at 45 cents, and removal of bowlders, at 12 cents per cubic yard, '89, 584.

1890. A. R. Wright, for dredging, at 32½ cents per cubic yard, and removal of bowlders, at \$5 each, '91, 660.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 30; '89, 40; '90, 34; '91, 43; '92, 49.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1886-'89. Report, '88, 458.

Lieut. Col. S. M. Mansfield, 1889. Reports, '89, 582; '90, 508; '91, 658; '92, 586.

**Operations.**

1887-'89. No operations, '88, 458; '89, 583.

1889-'90. 8,386 cubic yards material dredged, '90, 509.

1890-'91. No operations, '91, 659.

1891-'92. 30,000 cubic yards of material dredged, '92, 587.

**SCITUATE HARBOR, MASS.—Continued.****Projects.**

The project for the improvement proposed by Lieut. Col. Thom, and adopted in 1878, was for the construction of two rubble-stone jetties converging from opposite banks, and for dredging an anchorage basin with channels connecting with the sea and the town wharves, the north jetty from Cedar Point to be 800 feet long, and the south jetty from the point of the "First Cliff" to be 730 feet long; both jetties to be 20 feet wide on top and 4 feet above mean high water, except at their outer ends, which are to be built 6 feet higher to serve as sites for entrance beacons; the anchorage basin to be approximately 30 acres in area; the entrance channel to be 2,700 feet in length and 300 feet average width; recommendation by Board of Engineers, 1880, that area behind inner breakwater be excavated to a depth of 12 feet, increasing to 15 feet at the south end of the outer breakwater, '81, 526; '87, 523.

The estimated amount of dredging (including the entrance channel) was 500,000 cubic yards; estimated cost of jetties, \$100,000, and of the dredging, \$190,000, making a total for the project of \$290,000, '88, 458; '92, 587.

**SEBEWAING RIVER, MICH.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 362, 2804.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1891. Report, '91, 2804.

**Physical Characteristics.**

Description of the locality, '91, 2805.

**Plans.**

In 1890 Col. Poe did not consider the river worthy of improvement, '91, 2805.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Col. Poe, '91, 2804.

**SHALLOTTE RIVER, N. C.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 149; '90, 133.

ENGINEER IN CHARGE.

Capt. W. H. Bixby, 1888. Report, '90, 1184, 1186.

ASSISTANT.

H. G. Myrover. Report, '90, 1187.

**Physical Characteristics.**

Description of the locality, '90, 1186.

**Plans.**

By Capt. Bixby, 1889, for improvement of the river by straightening the channel and removing oyster-rock shoals for a distance of 9,000 feet; also the removal of 5 oyster-rock shoals in the upper portion of the river, so as to give a clear channel of 60 feet width and 4 feet depth at low water; estimated cost, \$30,000, '90, 1187.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '90, 1186.

**SHARK RIVER, N. J.—EXAMINATION OF.**

(Continued from Vol. II, p. 491.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 118.

ENGINEER IN CHARGE.

Maj. C. W. Raymond, 1890. Report, '91, 1092.

**SHARK RIVER, N. J.—Continued.****Physical Characteristics.**

Description of the locality, '91, 1092.

**Plans.**

In 1890 Maj. Raymond did not consider the river worthy of improvement, '91, 1092.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Raymond, '91, 1092.

**SHAWS COVE, New London Harbor, Conn.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 79.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1890. Report, '91, 833.

**Physical Characteristics.**

Description of the locality, '91, 833.

**Plans.**

By Col. Houston, 1890, for excavation of a channel 100 feet wide and 12 feet deep at mean low water, extending from the drawbridge along the north and west sides of the cove a distance of 2,000 feet; also an anchorage basin in the bend of the channel 400 feet by 800 feet; estimated cost, \$48,000, '91, 834.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Col. Houston, '91, 833.

**SHEBOYGAN HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 491.)

**Appropriations.**

1852-'87 .....	\$288, 448. 91
1888 .....	15, 000. 00, '88, 1855.
1890 .....	15, 000. 00, '90, 2347.
1892 .....	25, 000. 00, '92, 2195.

Total ..... 343, 448. 91

List of appropriations, '92, 2195.

**Commerce.**

Commercial importance of the harbor, '90, 2347.

**Contracts.**

1888. Truman &amp; Cooper, for 200 linear feet pier extension, at a total of \$10,656.60, '89, 2064.

1890. Truman &amp; Cooper, for 150 linear feet of pier extension, at \$9,893, '91, 2550.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 241; '89, 280, 309; '90, 253; '91, 323; '92, 309.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'—. Reports, '88, 1853; '89, 2063; '90, 2346; '91, 2549.

Col. O. M. Poe, 1889. Report, '89, 2243.

Maj. J. F. Gregory, 1892. Report, '92, 2194.

**Operations.**

1887-'88. North pier extended 200 feet; 14,485 cubic yards material dredged, '88, 1854.

1888-'89. South pier extension begun under contract; 20,150 cubic yards of material dredged by hired labor, '89, 2063.

1889-'90. 200 linear feet south pier extension completed under contract; 150 linear feet of shore end of south pier rebuilt above the water line by hired labor, and minor repairs made to north and south piers, '90, 2347.

1890-'91. 25,325 cubic yards of material dredged; 62 cords of stone used in refilling south pier, '91, 2549.

1891-'92. North pier extended 150 feet; 17,030 cubic yards of material dredged by hired labor, '92, 2194.

**SHEBOYGAN HARBOR, WIS.—Continued.****Projects.**

In 1852 and 1864 \$20,000 was appropriated, which was applied in extension of work undertaken by city of Sheboygan, '76, ii, 374; '81, 2105.

The project of 1866 proposed the extension of piers from the river's mouth to the 12-foot curve in the lake, with dredging to a depth of 12 feet in the channel between the piers, '66, i, 19, 24; iii, 12, 67, 75.

In 1873 the project was modified by additional pier extensions and dredging so as to obtain a channel 16 feet deep, '73, 513; '81, 2105. Total amount appropriated from 1852 to 1880, inclusive, \$190,448.91.

By Lieut. Col. Robert, 1881, for extension of piers to 20-foot curve in Lake Michigan, by construction of 1,085 linear feet of pile pier and 900 linear feet of crib pier; also for excavation of a channel 200 feet wide and 18 feet deep at the outer end, decreasing to 14 feet at the shore line; estimated cost, \$150,000, '81, 2104, 2108. Increased in 1884 to \$195,000, '84, 1856; '87, 2047; '91, 2549.

**Surveys.**

Survey made, 1890, under direction of Maj. Davis, '90, 2347.

**Maps.**

'88, 1854.

**SHEEPSHEAD BAY, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 492.)

**Appropriations.**

1880-'87 ..... \$21,000

1888..... 5,000, '88, 626.

Total ..... 26,000

List of appropriations, '88, 626; '90, 839.

**Contracts.**

1889. M. H. Flannery, for dredging, at 25 cents per cubic yard, '89, 814.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 64; '89, 83; '90, 74; '91, 96; '92, 99.

**ENGINEERS IN CHARGE.**

Lieut. Col. W. McFarland, 1886-'89. Report, '88, 624.

Capt. T. L. Casey, 1889-'—. Reports, '89, 814; '90, 837; '91, 982; '92, 868.

**Operations.**

1887-'89. No operations; expenditure of appropriation (1888) deferred, '88, 626; '89, 814.

1889-'90. 27,025 cubic yards material dredged, '90, 838.

1890-'92. No operations, '91, 982; '92, 868.

**Physical Characteristics.**

Description of the bay, '88, 624.

**Plans.**

In 1888, in view of the small commercial need for improvement, Lieut. Col. McFarland did not consider further appropriations necessary, '88, 626.

**Projects.**

By Lieut. Col. Newton, 1879, for improvement of Sheepshead Bay by diking and dredging; estimated cost, \$100,000, '79, 400; '86, 743, 745.

In 1882 the project was changed to one for the excavation of a crib 100 feet wide and 6 feet deep at mean low water, to connect Sheepshead Bay with Dead Horse Inlet; also for dredging within channel; estimated cost, \$34,200, '82, 671; '86, 744; '87, 735; '92, 868.

**SHENANDOAH RIVER, VA. AND W. VA.—SURVEY OF.**

(Continued from Vol. II, p. 493.)

**Appropriations.**

1880-'87 ..... \$17,500

**Engineers.****CHIEF OF ENGINEERS.**

Report, '90, 111.

**ENGINEER IN CHARGE.**

Lieut. Col. P. C. Hains, 1885-'90. Reports, '88, 804; '90, 1050.



**SHENANDOAH RIVER, VA. AND W. VA.—Continued.****Operations.**

1887-'90. Operations suspended pending transfer to the Government of the necessary land, '88, 804; '90, 1055.

**Physical Characteristics.**

Description of the river, '90, 1051.

**Plans.**

In 1890 Lieut. Col. Hains considered that the cost of improvement from the Jefferson County line to Bull Falls, \$49,802, was not warranted by existing commercial necessities, '90, 1055.

**Projects.**

By Lieut. Col. Craighill, 1880, for improvement of the Shenandoah River by slack-water navigation, securing a 20-foot width and 1½-foot depth at low water from Port Republic to Harpers Ferry, by rebuilding the locks, dams, and chutes of the navigation company; estimated cost, \$72,250, '80, 666, 667. (See Proviso of acts of 1880-'81, '85, 957.)

**SHIP CANAL to connect lakes Union, Washington, and Samamish with Puget Sound, Wash.—SURVEY FOR.****Appropriations.**

1890..... \$10,000

**Commerce.**

Shipping of Puget Sound, '92, 2767. Commercial interests of Seattle, Wash., '92, 2786.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 412; '92, 385.

**BOARD OF ENGINEERS.**

Convened at Portland, Oreg., December 15, 1891, by act of September 19, 1890, to select and survey the most feasible location, and to estimate the cost of construction of a ship canal to connect lakes Union, Washington, and Samamish with Puget Sound. Report, '92, 2762. (Col. Mendell, Maj. Handbury, and Capt. Symons.)

**ASSISTANT.**

P. G. Eastwick. Report, '92, 2772.

**Physical Characteristics.**

Description of the lakes and of possible routes, '92, 2764, 2765.

Physical data, '92, 2772, 2773.

Rainfall, 1878 to 1890, '92, 2778.

**Plans.**

By Board of Engineers, 1891, for a canal 2,600 feet long, 80 feet wide at bottom and 158 feet wide at the water line, and 26 feet deep through the portage between Union Bay in Lake Washington and Lake Union, with a masonry lock 400 feet long, 50 feet wide, 26 feet deep over sill, and with a lift of about 7½ feet; dredging channels to connect this canal with deep water in Lake Washington and across Lake Union, and constructing a canal 6,700 feet long, 80 feet wide at bottom and 158 feet wide at the water line, and 26 feet deep, connecting Lake Union along its outlet with the head of Salmon Bay. From the head of Salmon Bay to Puget Sound two routes were considered by the Board; one by way of Salmon Bay and Shilshole Bay, with a lock near the sound 400 feet long, 50 feet wide, and 16 feet deep over the sill at low tide; the other by way of Smiths Cove, and a canal 180 feet wide at bottom, 158 feet wide at the water line, and 26 feet deep, to be constructed across the neck of land between the head of Salmon Bay and Smiths Cove, with a lock near the sound similar to that projected for Shilshole Bay. The construction of a basin and the formation of a channel through the shoals were contemplated. The estimated cost of the proposed canal, between Lake Washington and Puget Sound by the two routes, not including damages for lands submerged, is as follows: Smiths Cove route, \$3,500,000; Shilshole Bay route, \$2,900,000. The Board reported in favor of the Smiths Cove route on the grounds that the entrance to this route would be in the harbor of Seattle, and less exposed to bombardment in time of war, '92, 2770, 2771.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '92, 2773.

**SHIP CHANNEL between Chicago, Duluth, and Buffalo.—**  
IMPROVEMENT OF.

**Appropriations.**

1892..... \$375,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 362.

ENGINEER IN CHARGE.

Col. O. M. Poe, 1891. Report, '91, 2811.

**Commerce.**

Freight traffic involved, '91, 2811, 2817.

**Physical Characteristics.**

Description of the locality, '91, 2817.

**Plans.**

By Col. Poe, 1891, for excavation of a ship channel 20 to 21 feet deep and of suitable width through the shallows of the connecting waters of the lakes between Chicago, Duluth, and Buffalo, at an estimated cost of \$3,339,567, '91, 2819.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Col. Poe, '91, 2811.

**SHIP CHANNEL between Port Townsend Bay, Puget Sound,**  
**and Oak Bay, Wash.—EXAMINATION FOR.**

**Appropriations.**

1892..... \$15,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 409, 3260.

ENGINEER IN CHARGE.

Capt. T. W. Symons, 1890. Report, '91, 3260.

ASSISTANT.

A. J. McMillan. Report, '91, 3262.

**Physical Characteristics.**

Description of the locality, '91, 3260.

**Plans.**

In 1890 Capt. Symons did not consider the proposed improvement desirable, '91, 3260.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Symons, '91, 3260.

**SHIP CHANNEL between Jersey City and Ellis Island, N. Y.—**  
SURVEY OF.

**Commerce.**

Amount of commerce to be benefited by improvement, '89, 804.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 83.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie, 1888. Report, '89, 801.

**Plans.**

By Lieut. Col. Gillespie, 1889, for excavation of a ship channel 2,375 feet long between Jersey City and Ellis Island, with a depth of 26 feet at mean low water and a width of 300 feet; estimated cost, \$108,462; also for a basin with a depth of 26 feet and an area of about 70 acres for anchorage purposes; estimated cost, \$442,340, '89, 803.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Gillespie, '89, 801.

MAPS.

'89, 802.

### SHOAL HARBOR AND COMPTONS CREEK, N. J.—IMPROVEMENT OF.

#### Appropriations.

1890..... \$5,000, '91, 1006.  
1892..... 3,000, '92, 893.

Total ..... 8,000

#### Contracts.

1891. E. Brainard, for dredging, at 24½ cents per cubic yard, '91, 1006.

#### Engineers.

##### CHIEF OF ENGINEERS.

Reports, '91, 106; '92, 108.

##### ENGINEER IN CHARGE.

Capt. T. L. Casey, 1890. Reports, '91, 1004; '92, 892.

#### Operations.

1890-'91. 10,808 cubic yards material dredged, '91, 1006.

1891-'92. 4,921 cubic yards material dredged, '92, 893.

#### Projects.

By Maj. Gillespie, 1884, for the formation of a channel in the creek, by dredging, 150 feet wide and 5 feet deep at low water between the harbor and the bay; estimated cost, \$64,140, '84, 771, 773; '91, 1006.

### SHOALWATER BAY AND WILLOPAH RIVER, WASH.—EXAMINATION OF.

#### Engineers.

##### CHIEF OF ENGINEERS.

Report, '91, 409.

##### ENGINEER IN CHARGE.

Capt. T. W. Symons, 1890. Report, '91, 3266, 3268.

##### ASSISTANTS.

R. A. Habersham. Report, '91, 3267.

A. J. McMillan. Report, '91, 3271.

#### Physical Characteristics.

Description of the bay and river, '91, 3267, 3270.

#### Plans.

After examination of Shoalwater Bay and survey of Willopah River in 1890, Capt. Symons reported the former locality as unworthy of improvement, and proposed the improvement of Willopah River by deepening the shoals so as to secure a minimum depth of 8 feet at mean low water up to Willopah City, at an estimated cost of \$31,350, '91, 3267, 3269.

#### Surveys.

Examination of Shoalwater Bay made, 1890, under direction of Capt. Symons, '91, 3267. Survey of Willopah River ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '91, 3268.

#### MAPS.

'91, 3268.

### SHREWSBURY RIVER, N. J.—IMPROVEMENT OF.

(Continued from Vol. II, p. 494.)

#### Appropriations.

1852-'87..... \$204,500  
1888..... 10,000, '88, 667.  
1890..... 10,000, '90, 862.  
1892..... 10,000, '92, 896.

Total ..... 234,500

List of appropriations, '92, 896.

#### Commerce.

Importance of the river's commerce, '88, 666.

**SHREWSBURY RIVER, N. J.—Continued.****Contracts.**

1888. A. J. Howell, for stone delivered in place, at \$1.45 per cubic yard, '88, 667.  
 1891. P. S. Ross, for dredging, at 35 cents per cubic yard; G. Humphreys, for timber dike construction, at \$7.75 per linear foot, '91, 1009.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 74; '89, 92; '90, 83; '91, 106; '92, 108.

**ENGINEERS IN CHARGE.**

Capt. G. McC. Derby, 1887-'89. Report, '88, 665.

Capt. T. L. Casey, 1889-'— . Reports, '89, 836; '90, 860; '91, 1007; '92, 894.

**Operations.**

- 1887-'88. 1,000 linear feet of stone dike built; guide piles driven, '88, 666.  
 1888-'89. 11,945 cubic yards material dredged, '89, 837.  
 1889-'90. 12,215 cubic yards material dredged, '90, 862.  
 1890-'91. 11,045 cubic yards material dredged, '91, 1008.  
 1891-'92. Repairs to dike at mouth of the river; 1,956 cubic yards of material dredged, '92, 895.

**Physical Characteristics.**

Tidal observations, '86, 666.

Description of the locality, '90, 861.

**Projects.**

The projects of 1870 proposed dredging channels through the shoals in both branches of the river, at an estimated cost of \$14,000, '71, 703. This amount was appropriated in 1871, with an additional \$5,000 in 1873, but the improvement was not permanent, '86, 104.

The existing project, adopted in 1879, was for securing, by dredging and by contracting the wider portions of the river by the use of dikes, channels 6 feet deep at mean low water and from 200 to 300 feet wide, and extending from the 6-foot curve at the mouth in Sandy Hook Bay up to the 6-foot curves on both branches of the river in the bays above; estimated cost, as modified by the Board of Engineers, \$142,086, '79, 408, 411; '86, 757.

In 1880 Col. Michler proposed the change of the proposed channel from the west to the east side of the Island A in the South Branch, '81, 701. Concurred in by Board of Engineers, 1880, '81, 704.

The amount appropriated from 1852 to 1886, inclusive, was \$204,000. In 1887 the total estimated cost was revised to \$254,562, '87, 781.

**Surveys.****MAPS.**

'90, 862; '92, Atlas, 7.

**SIoux CITY, IOWA.—(See MISSOURI RIVER BETWEEN MOUTH AND SIOUX CITY.)****SIPSEY RIVER, ALA.—SURVEY OF.**

(Continued from Vol. II, p. 495.)

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 193; '90, 175.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1888. Report, '90, 1722.

**Physical Characteristics.**

Description of the locality, '90, 1723.

**Plans.**

By Maj. Damrell, 1890, for improvement of the river from the Tombigbee River at Vienna to Texas, giving a four-months' navigation by removal of snags, logs, and similar obstructions, and construction of contraction works; estimated cost, \$100,000, '90, 1724.

**Surveys.**

Survey from the Tombigbee River at Vienna to Texas ordered by act of August 11, 1888. Made, 1890, under direction of Maj. Damrell, '90, 1722.

**SINSLAW RIVER AND BAR, OREG.—IMPROVEMENT OF.****Appropriations.**

1890..... \$50,000, '91, 3175.  
 1892..... 20,000, '92, 2687.

Total ..... 70,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 358; '90, 324; '91, 402; '92, 378.

**BOARD OF ENGINEERS.**

Convened at Portland, Oreg., June 11, 1891, by S. O. No. 23, to report upon project for improving the mouth of Sinslaw River. Report, '91, 3175. (Maj. Handbury, Capt. Symons, and Lieut. Burr.)

**ENGINEERS IN CHARGE.**

Capt. W. Young, 1888-'91. Report, '90, 2999, 3002.

Capt. T. W. Symons, 1891-'—. Reports, '91, 3173; '92, 2681.

**ASSISTANT.**

G. A. Lyell. Reports, '90, 3004; '92, 2687.

**Operations.**

1891-'92. Construction and preparation of plant, '92, 2687, 2691.

**Physical Characteristics.**

Description of the locality, '90, 3002; '91, 3177.

**Plans.**

By Capt. Young, 1889, for construction of two high-tide stone jetties converging until the width between them is about 500 feet and then running out to sea parallel to each other for a sufficient distance to open and maintain a channel over the bar with a low-water depth of 10 feet; estimated cost, \$280,190, '90, 3003.

**Projects.**

By Board of Engineers, 1891, for improvement of Sinslaw River at its mouth by the construction of two converging jetties extending from the river's mouth out across the ocean bar; the jetties to be of rubble stone raised to full high tide with brush mattress foundation; the north jetty to be 7,500 feet in length, and the south jetty 5,700 feet in length; estimated cost, including the construction of plant for building the north jetty, \$751,850, '91, 3180.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Young, '90, 3002.

**MAPS.**

'91, 3175, 3178.

**SKAGIT, STEILACQUAMISH, NOOTSACK, SNOHOMISH, AND SNOQUALMIE RIVERS, WASH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 496.)

**Appropriations.**

1880-'87 ..... \$42,500  
 1888..... 15,000, '88, 2176.  
 1890..... 12,000, '90, 2987.  
 1892..... 15,000, '92, 2730.

Total ..... 84,500

List of appropriations, '91, 3239.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 303; '89, 361; '90, 323; '91, 408, 410; '92, 383.

**ENGINEERS IN CHARGE.**

Maj. T. H. Handbury, 1888-'90. Reports, '88, 2176; '89, 2561, 2564.

Capt. T. W. Symons, 1890-'—. Reports, '90, 2986; '91, 3238, 3271; '92, 2729.

**ASSISTANT.**

E. H. Jefferson. Reports, '89, 2562; '90, 2988; '91, 3243, 3273; '92, 2731.

**Operations.**

1887-'88. 708 snags cleared from the Snohomish and Snoqualmie rivers '88, 2176.

1888-'89. 1,527 snags and 449 trees removed from the Skagit, Nootsack, and Snohomish rivers, '89, 2561.

1889-'90. No operations, '90, 2987.

1890-'91. 769 snags and 44 leaning trees cleared from the Snohomish, Steilacquamish, and Skagit rivers, '91, 3244.

**SKAGIT, STEILAQUAMISH, NOOTSACK, SNOHOMISH, AND SNOQUALMIE RIVERS, WASH.—Continued.****Operations—Continued.**

1891-'92. 1,175 snags and 144 leaning trees cleared from the Snohomish, Steilaquamish, Skagit, and Nootsack rivers, '92, 2731.

**Physical Characteristics.**

Description of the locality, '90, 2988; '91, 3273.

**Plans.**

After examination of the Nootsack, Skagit, and Snohomish rivers in 1890 Capt. Symons reported that the present or prospective demands of commerce did not justify a further expenditure for improvement, '91, 3272.

**Projects.**

By Maj. Gillespie, 1881, for construction of snag boat and maintenance of same for one year; estimated cost, \$25,000, '81, 2682. Increased \$5,000 in 1882, '82, 2686, and \$10,000 in 1884, '84, 2275. Estimate for completion, 1886, \$29,000, '86, 2008; '92, 2729.

**Surveys.**

Examination of the Nootsack, Skagit, and Snohomish rivers made 1890, under direction of Capt. Symons, '91, 3271.

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**SMITHLAND HARBOR, KY.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 285, 2289.

ENGINEER IN CHARGE.

Lieut. Col. J. W. Barlow, 1890. Report, '91, 2289.

**Physical Characteristics.**

Description of the locality, '91, 2289.

**Plans.**

In 1890 Lieut. Col. Barlow did not consider the locality worthy of improvement, '91, 2289.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Barlow, '91, 2289.

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**SMITHS CREEK, MD.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 146.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1890. Report, '91, 1282.

**Physical Characteristics.**

Description of the locality, '91, 1282.

**Plans.**

In 1891 Lieut. Col. Hains considered the existing channel facilities sufficient for the requirements of commerce, '91, 1283.

**Surveys.**

Examination made, 1891, under direction of Lieut. Col. Hains, '91, 1283.

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**SMYRNA RIVER (DUCK CREEK), DEL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 182.)

**Appropriations.**

1880-'82 .....	\$10,000
1888 .....	10,000, '88, 742.
1890 .....	5,000, '90, 924.
1892 .....	3,000, '92, 953.

Total ..... 28,000  
List of appropriations, '89, 886.

**SMYRNA RIVER (DUCK CREEK), DEL.—Continued.****Contracts.**

1889. F. C. Somers, for dredging, at 19 cents per cubic yard, '89, 885.

1891. National Dredging Company, for dredging, at 17 cents per cubic yard, '91, 1164.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 88; '89, 104; '90, 94; '91, 121; '92, 121.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1885.—. Reports, '88, 741; '89, 885; '90, 923; '91, 1162; '92, 951.

**Operations.**

1887-'88. No operations for lack of funds, '88, 741.

1888-'89. 45,151 cubic yards material dredged, '89, 885.

1889-'90. No operations, '90, 923.

1890-'91. 13,139 cubic yards of material dredged, '91, 1163.

1891-'92. 12,000 cubic yards of material dredged, '92, 951.

**Projects.**

By Col. Macomb, 1879, for widening old "cut-off" and removing shoals by dredging; estimated cost, \$12,000, '79, 471.

Revised, 1881, by Col. Macomb, for excavation of an 8-foot channel through the bar not less than 100 feet wide; also for removal of shoals in the creek, making the entire cost of the project \$24,000, '81, 128, 788.

By W. F. Smith, 1886, for a 7-foot low-water navigation to the town of Smyrna, Del., the head of navigation; the channel at the entrance to be 100 feet wide and inside the creek 60 feet wide; the channel to be protected at the entrance by the construction of a stone jetty; estimated cost, \$90,698.40, '88, 742; '92, 952.

**SNAKE RIVER (UPPER), IDAHO.—SURVEY OF.****Appropriations.**

1892..... \$20,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 411.

ENGINEER IN CHARGE.

Capt. T. W. Symons, 1891. Report, '91, 3285, 3288.

ASSISTANTS.

A. J. McMillan. Report, '91, 3286.

Wm. Cuthbert. Report, '91, 3289.

**Physical Characteristics.**

Description of the locality, '91, 3286.

**Plans.**

By Capt. Symons, 1891, for improvement of the river between the Huntingdon Bridge and Seven Devils mining district, giving a channel for steamboat navigation of 150 feet width by rock removal, at an estimated cost of \$80,000, '91, 3288.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '91, 3288.

**MAPS.**

'91, 3291. '92, Atlas, 121, 122, 123.

**SNOHOMISH RIVER.—(See SKAGIT RIVER, WASH.)****SNOQUALMIE RIVER.—(See SKAGIT RIVER, WASH.)**

**SOCASSEE CREEK, S. C.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 158.

ENGINEER IN CHARGE.

Capt. F. V. Abbot, 1888. Report, '89, 1214.

**Physical Characteristics.**

Description of the locality, '89, 1214.

**Plans.**

By Capt. Abbot, 1889, for improvement of the creek by excavation of a cut 40 feet wide and 4 feet deep at low water through the Cypress Swamp from the bridge at Socassee, for about three-fourths of a mile; also clearing out obstructions and widening and deepening places below proposed cut; estimated cost, \$10,000, '89, 1215.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Abbot, '89, 1214.

**SODUS HARBOR (GREAT), N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 499.)

**Appropriations.**

1829-'87 .....	\$403, 646. 80
1888 .....	24, 000. 00, '88, 2078.
1890 .....	10, 000. 00, '90, 2857.
1892 .....	15, 000. 00, '92, 2571.

Total .....	452, 646. 80
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**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 282; '89, 334; '90, 303; '91, 380; '92, 358.

ENGINEERS IN CHARGE.

Capt. C. F. Palfrey, 1887-'90. Reports, '88, 2075, 2078; '89, 2411.

Maj. M. B. Adams, 1890-'91. Report, '90, 2855.

Capt. D. C. Kingman, 1891-'— . Reports, '91, 2906; '92, 2564.

**Operations.**

1887-'88. Dredging by centrifugal pump; reconstruction of east pier superstructure begun by hired labor, '88, 2076.

1888-'89. East breakwater deck completed; repairs to scow, and to east and west piers, '89, 2412.

1889-'90. Renewal of west pier superstructure completed; 23,386 cubic yards material dredged, '90, 2856.

1890-'91. 500 linear feet of superstructure renewed on east pier; repairs to outer end of west pier; minor repairs to existing works, '91, 2907.

1891-'92. 640 linear feet of east breakwater superstructure renewed; repairs to light-house crib on west jetty; 11,219 cubic yards of material dredged, '92, 2570.

**Projects.**

After an aggregate of appropriations amounting to \$351,771.80 Maj. McFarland proposed, in 1881, the extension of the east and west piers to 15-foot curve and deepening the channel to 15 feet by dredging; estimated cost, \$100,000, '81, 2442; '87, 2376.

In 1889 Capt. Palfrey estimated that for maintenance of existing works, dredging the entire space between the piers to hard bottom, giving a channel 200 feet wide and 15 feet deep at extreme low water, would require, over and above prior appropriations, \$54,000, '89, 2413, 2414.

In 1891 Capt. Kingman estimated \$58,000 as required for completion of the project, '91, 2908.

**SODUS HARBOR (LITTLE), N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 499.)

**Appropriations.**

1852-'87 .....	\$281, 941. 77
1888 .....	16, 000. 00, '88, 2082.
1890 .....	13, 000. 00, '90, 2861.
1892 .....	6, 000. 00, '92, 2579.

Total .....	316, 941. 77
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**SODUS HARBOR (LITTLE), N. Y.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 283; '89, 335; '90, 303; '91, 380; '92, 359.

**ENGINEERS IN CHARGE.**

Capt. C. F. Palfrey, 1887-'90. Reports, '88, 2079; '89, 2415.

Maj. M. B. Adams, 1890. Report, '90, 2858.

Capt. D. C. Kingman, 1891-'— Reports, '91, 2909; '92, 2572.

**Operations.**

1887-'88. 200 linear feet of stake and fascine shore revetment built; 512 linear feet of east pier superstructure rebuilt; outer end of west pier repaired, and minor repairs to deck of east breakwater, '88, 2081.

1888-'89. 3 pockets in west pier rebalasted, and 1,020 linear feet of superstructure renewed; 980 linear feet of east breakwater superstructure renewed, '89, 2416.

1889-'90. Repairs to east and west piers, '90, 2859.

1890-'91. No operations, '91, 2910.

1891-'92. 800 linear feet of east breakwater superstructure built; 541 cubic yards of hardpan and 7,257 cubic yards of sand dredged, '92, 2579.

**Projects.**

The earliest plan of improvement was submitted in 1829 by Capt. T. W. Maurice. The first appropriation was made in 1852, '74, i, 256; '76, ii, 591. The present project, adopted in 1881, was an expansion of the earlier projects, and proposed to furnish a channel of entrance not less than 15 feet deep by the closure of one side of the bay by a lateral pier of crib work filled with stone, in connection with two parallel piers extending out into the lake, '79, 1731; '81, 2444; '87, 2379. The total amount appropriated from 1852 to 1888, inclusive, was \$281,941.77; amount estimated to complete project, \$32,500, '86, 344, 1892; '87, 2381.

Increased to \$46,600 in 1889, '89, 2417, and to \$58,500 in 1891, '91, 2911.

**SOUTH EAST RIVER, MD.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 112.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1888. Report, '89, 911.

**ASSISTANT.**

A. Stierle. Report, '89, 912.

**Physical Characteristics.**

Description of the locality, '89, 912.

**Plans.**

In 1889 Col. Craighill did not consider the locality worthy of improvement, '89, 913.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of W. F. Smith, '89, 911.

**SOUTH HAVEN HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 501.)

**Appropriations.**

1887-'87 .....	\$182,000
1888.....	10,000, '88, 1917.
1890.....	15,000, '90, 2657.
1892.....	10,000, '92, 2356.

Total ..... 217,000

List of appropriations, '92, 2355.

**Contracts.**

1889. Weimar, Rath & Gaylord, for crib construction upon pile foundation, at a total of \$5,837, '89, 2193.

**SOUTH HAVEN HARBOR, MICH.—Continued.****Contracts—Continued.**

1891. F. A. Hagen, for stone, at \$2.24 per cord; Parkhurst & Wilkinson, for tie rods, bolts, and spikes, at 2½ cents per pound; Gaylord & Wing, for white pine timber and plank, at \$18 and \$16 per M feet, B. M.; J. M. Allmendinger, for Norway pine piles, at 12½ cents per linear foot, '91, 2701.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 257; '89, 302; '90, 272; '91, 342; '92, 328.

ENGINEERS IN CHARGE.

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1916.

Maj. W. Ludlow, 1889-'—. Reports, '89, 2191; '90, 2656; '91, 2700; '92, 2353.

**Operations.**

1887-'88. South pier extended 50 feet under contract; 1,750 cubic yards material dredged, '88, 1916.

1888-'89. 6,000 cubic yards material dredged, '89, 2192.

1889-'90. 24,960 cubic yards material removed by Government dredge; 4,390 cubic yards material dredged by citizens of South Haven; repairs to north and south piers, '90, 2656.

1890-'91. Repairs to outer circle of north pier in progress, '91, 2700.

1891-'92. 11,670 cubic yards of material dredged from the channel; repairs to outer crib of north pier completed; double sheet piling driven along 520 feet of rear wall of north pile revetment; 460 linear feet of north plank beam changed to sheet-pile revetment; 192 linear feet of sand fence built, '92, 2354.

**Private and Corporate Work.**

Dredging done by citizens of South Haven, '90, 2656.

**Projects.**

The original project of 1866 proposed the extension of two parallel piers 120 feet apart from the mouth of the river to the 12-foot curve in the lake, the protection of the river banks by sheet-pile revetment, and dredging a channel 12 feet deep between the piers and across the outer bars; estimated cost, \$128,288, '66, iv, 148; '74, i, 192; '79, 1628.

In 1879 the project was modified, increasing the channel depth to 14 feet, '79, 1628; '81, 2236. Total amount appropriated from 1867 to 1886, inclusive, \$182,000. Amount estimated to complete project in 1886, \$77,500, '86, 316; '87, 2199; '92, 2356.

**SOUTHPORT HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 502.)

**Appropriations.**

1836-'82..... \$21,000

List of appropriations, '88, 562.

**Engineers.**

ENGINEER IN CHARGE.

Col. D. C. Houston, 1886-'88. Report, '88, 561.

**Operations.**

1887-'88. No operations; project for improvement completed, '88, 561, 562.

**Physical Characteristics.**

Description of the harbor, '88, 561.

**Projects.**

The earliest project, 1827, provided for a stone breakwater, extending southward 1,420 feet on the east side of the harbor, and a dike extending northward 1,450 feet from the head of the breakwater. This work was completed in 1838, at a cost of \$10,587.23, '70, 453; '86, 648.

In 1875 the breakwater was repaired and raised 2 feet, '76, i, 53, 229; '86, 648.

In 1876 the project was modified to provide for dredging a channel 50 feet wide and 4 feet deep at low water from Long Island Sound to the wharves at Southport. In 1877 the project was amended to provide for 100 feet width, '78, 406; '79, 59, 355; '86, 648.

The project was practically completed in 1883, '83, 522; '84, 653; '86, 648.

Total appropriations, 1829 to 1882, inclusive, \$31,587.23, '86, 649; '87, 616.

**SOUTHPORT HARBOR, WIS.—(See KENOSHA HARBOR.)**

**SOUTH RIVER, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 503.)

**Appropriations.**

1871-'87 .....	\$81,000
1888.....	5,000, '88, 660.
1890.....	5,000, '90, 860.
1892.....	7,000, '92, 888.

Total ..... 98,000

List of appropriations, '92, 888.

**Commerce.**

Increase of, '88, 659, 661.

**Contracts.**

1891. E. M. Payn, for dredging, at 38½ cents per cubic yard, '91, 1001.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 72; '89, 91; '90, 82; '91, 103; '92, 105.

ENGINEERS IN CHARGE.

Capt. G. McC. Derby, 1886-'89. Report, '88, 657.

Capt. T. L. Casey, 1889-'— . Reports, '89, 834; '90, 858; '91, 999; '92, 887.

**Operations.**

1887-'88. 16,815 cubic yards material dredged from channel between Dikes D and E, and from shoal at Diike F, '88, 659.

1888-'91. No operations, '89, 835; '90, 859; '91, 1000.

1891-'92. 10,551 cubic yards material dredged, '92, 887.

**Physical Characteristics.**

Description of the stream, '88, 657.

**Projects.**

By Col. J. Newton, 1879, for improvement of South River by rectification of the entrance to the artificial channel or canal into the Raritan River; closing the South River below Petit's brickyard, increasing by means of dikes and dredging the depth to 8 feet at mean low water up to Washington, 6 feet to Bissetts, and 4 feet to old bridge, involving the construction of 15,200 linear feet of dike and 3,200 feet of half-dike, and dredging; estimated cost, \$194,695, '80, 522, 523; '87, 773.

**SPRING CREEK, N. Y.—EXAMINATION OF.**

(Continued from Vol. II, p. 503.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 67, 638.

ENGINEER IN CHARGE.

Lieut. Col. W. McFarland, 1888. Report, '88, 638.

ASSISTANT.

G. W. Kuehule. Report, '88, 639.

**Physical Characteristics.**

Description of the creek, '88, 638, 639.

**Plans.**

In view of the absence of all commerce Lieut. Col. McFarland does not consider the creek worthy of improvement by the General Government, '88, 639.

**Surveys.**

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. McFarland, '88, 638.

**STAGE HARBOR, MASS.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 44.

ENGINEER IN CHARGE.

Lieut. Col. S. M. Mansfield, 1888. Report, '89, 599.

**Physical Characteristics.**

Description of the locality, '89, 599.

**STAGE HARBOR, MASS.—Continued.****Plans.**

By Lieut. Col. Gillespie, 1888, for improvement of the harbor entrance by dredging, at an estimated cost of \$15,000, '89, 600.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Gillespie, '89, 599.

**STAMFORD HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 503.)

**Appropriations.**

1886-'87 .....	\$10,000
1888 .....	5,000, '88, 564.
1890 .....	5,000, '90, 649.
1892 .....	15,000, '92, 700.

Total ..... 35,000

List of appropriations, '88, 566.

**Contracts.**

1889. Hartford Dredging Company, for dredging, at 18 cents per cubic yard, '89, 714.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 52; '89, 65; '90, 58, 332; '91, 72, 80; '92, 77.

**BOARD OF ENGINEERS.**

Convened at New York, November 30, 1889, by S. O. No. 78, to report upon the location of harbor lines in Stamford Harbor, '90, 332, 682, 683. Description of harbor lines as recommended for approval, '90, 686. (Col. Houston, Lieut. Col. Gillespie, and Capt. Cusey.)

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1886.— Reports, '88, 564; '89, 712; '90, 648; '91, 795, 848, 849; '92, 699.

**ASSISTANT.**

H. N. Babcock. Report, '91, 850.

**Operations.**

1887-'88. 30,846 cubic yards material dredged from the channel, '88, 565.

1888-'89. 22,504 cubic yards material dredged, '89, 713.

1889-'90. No operations for lack of funds, '90, 649.

1890-'91. 15,550 cubic yards of material dredged, '91, 796.

1891-'92. 7,365 cubic yards of material dredged, '92, 700.

**Physical Characteristics.**

Description of the harbor, '88, 564.

**Plans.**

By Col. Houston, 1891, for increasing the channel depth to 7 feet mean low water and widening it to 150 feet; also further dredging in the harbor basin; estimated cost, \$35,000, '91, 849.

**Projects.**

By Maj. Barlow, 1883, for the formation of a dredged channel 5 feet deep at mean low water, extending from the Oliver Street Bridge across Mill Creek to the bay; estimated cost, \$20,000 '84, 672; '87, 619.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Col. Houston, '91, 849.

**STATEN ISLAND AND NEW JERSEY.—IMPROVEMENT OF CHANNEL BETWEEN.**

(See also ARTHUR KILL.)

(Continued from Vol. II, p. 504.)

**Appropriations.**

1874-'87 .....	\$169,000
1888 .....	15,000, '88, 633.
1890 .....	15,000, '90, 847.
1892 .....	15,000, '92, 872.

Total ..... 214,000

List of appropriations, '88, 632; '92, 872.

8648—28

**STATEN ISLAND AND NEW JERSEY—Continued.****Commerce.**

Value of commerce passing Stake Light, '88, 632.

**Contracts.**

1889. T. H. Benton, for dredging, at 27 cents per cubic yard, '90, 846.

1891. T. H. Benton, for dredging, at 26 cents per cubic yard, '91, 987.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 66; '89, 86; '90, 77; '91, 98; '92, 101.

**ENGINEERS IN CHARGE.**

Lient. Col. W. McFarland, 1886-'89. Report, '88, 631.

Capt. T. L. Casey, 1889-'—. Reports, '89, 821; '90, 846; '91, 986; '92, 871.

**Operations.**

1887-'88. 15,000 cubic yards material dredged, '88, 632.

1888-'89. No operations, '89, 821.

1889-'90. 44,041 cubic yards material dredged, '90, 846.

1890-'91. 44,820 cubic yards material dredged, '91, 986.

1891-'92. No operations, '92, 872.

**Projects.**

By Board of Engineers, 1880 (in extension of previous projects of 1873 and 1875), for formation of a channel between Staten Island and New Jersey east from Elizabethport to the deep water of the Kill Von Kull, 400 feet wide, the middle 200 feet to be 13 feet and the remainder of the channel 12 feet deep at mean low water; in addition, if found necessary, parallel dikes to be built on opposite sides of the channel at two places; estimated cost, \$185,705, '81, 109, 692, 695; '86, 790. (Cols. Tower and Newton and Lieut. Col. Abbot.) Estimate increased to \$210,000, '87, 745.

In 1890 the project was modified to meet the increased demands of commerce, and now calls for a uniform depth of 14 feet over the entire width of 400 feet; estimate for completion in 1891, \$61,000, '91, 987.

**Surveys.****MAPS.**

'89, 822.

**STAUNTON RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 505.)

**Appropriations.**

1879-'87 .....	\$12,000
1880-'87 .....	27,500
1888 .....	5,000, '88, 836.
1890 .....	8,000, '90, 1082.

Total ..... 52,500

List of appropriations, '88, 837; '89, 1021.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 114; '89, 132, 133; '90, 119, 120; '91, 153; '92, 154.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1878-'91. Reports, '88, 834, 836; '89, 1020, 1022; '90, 1081, 1082.

Capt. W. H. Bixby, 1891-'92. Report, '91, 1328.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1099.

**Operations.**

1887-'88. (P. R. to B. N.) 250 cubic yards loose and 550 cubic yards blasted rock removed from the channel; (B. N. to R. Sta.) 1,200 cubic yards rock removed from the channel; 308 cubic yards rock quarried, and 182 cubic yards placed in wing dams, '88, 835.

1888-'89. (P. R. to B. N.) 175 cubic yards rock removed from the channel, '89, 1022. (B. N. to R. Sta.) 341 cubic yards granite quarried, and 437 linear feet of riprap dam built, '89, 1021.

1889-'90. (P. R. to B. N.) No operations for lack of funds, '90, 1082. (B. N. to R. Sta.) 144 cubic yards stone blasted, and 30 cubic yards removed from the channel; repairs to dams, '90, 1081.

1890-'92. No operations upon either section of the river, '91, 1329; '92, 1100.

**STAUNTON RIVER, VA.—Continued.****Projects.**

By S. T. Abert, 1879, for improvement of Staunton River from Brook Neal to Randolph Station, a distance of 32 miles, by rock removal and spur dike and dam construction, so as to give a low-water channel of 2 feet depth and 35 feet width; estimated cost, \$68,708, '80, 783, 786; '87, 950.

By S. T. Abert, 1882, for improvement of Staunton River from Brook Neal to the mouth of Pig River, a distance of 52 miles, by construction of spur dikes and rock excavation, chiefly to reduce the slope of the river for batteau navigation; estimated cost, \$40,087, '82, 1048, 1052; '87, 952.

Reduced to \$34,000 in 1889, '89, 1023.

The two works were consolidated in 1890, and \$50,200 was estimated as required for completion of projects for improvement of the upper and lower river, '91, 1328; '92, 1103.

In 1892, after a total expenditure upon both sections of the river of \$44,700, it was recommended that further work be discontinued, '92, 1103.

**STEELS BAYOU, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 506.)

**Appropriations.**

1884-'87 .....	\$5, 000
1888.....	2, 500, '88, 1365.
1890.....	2, 500, '90, 1901.
1892.....	2, 500, '92, 1653.

Total ..... 12, 500

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 182; '89, 214; '90, 198; '91, 244; '92, 237.

**ENGINEER IN CHARGE.**

Capt. J. H. Willard, 1887-'—. Reports, '88, 1364; '89, 1615; '90, 1900; '91, 2005; '92, 1651.

**Operations.**

1887-'88. No operations, '88, 1364.

1888-'89. 111 snags removed from the channel, and 480 trees and 44,950 yards brush cleared from the banks, '89, 1616.

1889-'90. 7 snags removed from the channel, and 142 trees cleared from the banks, '90, 1900.

1890-'91. 87 snags, 42 log jams, and 38 leaning trees cleared and removed, '91, 2006.

1891-'92. 28 snags, 157 logs, 1,599 trees, and 11,800 square yards of brush removed from the river and banks, '92, 1652.

**Projects.**

By Maj. Miller, 1883, for improvement of the bayou from its mouth to Swan Lake by removal of obstructions at low water, giving a seven-months' navigable channel; estimated cost, \$14,960, '84, 1362.

**STEILAQUAMISH RIVER.—(See SKAGIT RIVER, WASH.)****STILL POND HARBOR, MD.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 112.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1888. Report, '89, 908.

**ASSISTANT.**

A. Stierle. Report, '89, 907.

**STILL POND HARBOR, MD.—Continued.****Physical Characteristics.**

Description of the locality, '89, 907.

**Plans.**

In 1888 Mr. Smith did not consider the locality worthy of improvement, '89, 907.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of W. F. Smith, '89, 906.

**STONINGTON HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 507.)

**Appropriations.**

1827-'87 .....	\$294,453.83
1888.....	8,000.00, '88, 512.
1890.....	12,500.00, '90, 582.
1892.....	12,500.00, '92, 637.

Total ..... 327,453.83

**Contracts.**

1889. C. F. Stoll, for furnishing and placing riprap granite, at \$11.07 per ton, '89, 640.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 43; '89, 54; '90, 49; '91, 60; '92, 65.

ENGINEERS IN CHARGE.

Maj. W. R. Livermore, 1887-'92. Reports, '88, 511; '89, 637; '90, 581, '91, 729.

Capt. W. H. Bixby, 1892-'— . Report, '92, 635.

**Operations.**

1887-'88. 3,550 tons of riprap stone placed in the breakwater, '88, 512.

1888-'89. 3,664 tons riprap granite placed in the breakwater, '89, 638.

1889-'90. 1,925 tons stone placed in the eastern breakwater, '90, 581.

1890-'91. 10,701 tons of stone placed in the eastern breakwater, '91, 729.

1891-'92. 447 tons of stone placed in the eastern breakwater, '92, 636.

**Physical Characteristics.**

Description of the locality, '90, 581.

**Projects.**

The earliest project, 1827, provided for the construction of a short breakwater at the lower end of the city wharves; this was completed in 1831 at a cost of \$34,766.65, '72, 920; '79, 327; '87, 41.

The project of 1871 proposed dredging a channel 12 feet deep between the breakwater and the steamboat wharf, at an estimated cost of \$51,368, '72, 919; '73, 980.

By the Board of Engineers, 1875, for a breakwater of granite riprap to extend southeast from the vicinity of Wampasset Point, a distance of about 2,000 feet; estimated cost, \$231,000, '75, ii, 244, 246. Breakwater completed in 1881, at a cost of \$103,190, '81, 579; '87, 562.

By Maj. Barlow, 1880, for an east breakwater between the Middle Ground and Bartletts Reef, 2,000 feet in length, to be built of stone and granite riprap; estimated cost, \$100,000, '81, 585. Approved by Board of Engineers, 1880, '81, 585.

Necessity for increasing length of breakwater to 2,600 feet, making the estimated cost \$130,000, '82, 598. Amount estimated for completion in 1888, \$25,000, '88, 512.

**STONY CREEK RIVER, CONN.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 79.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1890. Report, '91, 831.

**Physical Characteristics.**

Description of the locality, '91, 832.

**STONY CREEK RIVER, CONN.—Continued.****Plans.**

In 1890 Col. Houston did not consider the locality worthy of improvement, '91, 833.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Col. Houston, '91, 831.

**STURGEON BAY CANAL, WIS.—CONSTRUCTION OF HARBOR OF REFUGE AT.**

(Continued from Vol. II, p. 508.)

**Appropriations.**

1873-'87 .....	\$167, 000
1890 .....	3, 000, '90, 2337.
1892..... {	5, 000
	81, 833
Total .....	256, 833

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 238; '89, 277; '90, 250; '91, 321; '92, 306.

**ENGINEERS IN CHARGE.**

Maj. C. E. L. B. Davis, 1886-'92. Reports, '88, 1844; '89, 2051; '90, 2336; '91, 2536.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2182.

**Operations.**

1887-'89. No operations, '88, 1845; '89, 2052.

1889-'90. 7,478 cubic yards material dredged; 200 linear feet of north pier and 175 linear feet of south pier rebuilt by hired labor, '90, 2337.

1890-'91. No operations, '91, 2537.

1891-'92. 13,640 cubic yards of material dredged by hired labor; repairs to bulk-heads and sheet piling of north and south piers, '92, 2183.

**Projects.**

By Maj. Houston, 1871-'74, for two piers to protect entrance to the canal at Lake Michigan, each pier beginning at a point on the shore line 425 feet from the axis of the canal, extending into the lake and narrowing to 235 feet at the outer ends, each about 1,200 feet long and extending to the 18-foot curve; also the dredging of the outer basin to a depth of 13 feet; estimated cost, \$180,000, '72, 171; '74, i, 141.

In 1879-'80 Maj. Robert proposed the construction of 1,392 linear feet of sheet-pile revetment to render the existing pile piers sand-tight; the widening of the harbor entrance to 325 feet by the construction of 150 linear feet detached pier on each side, with fender piling to connect the ends of the detached piers with ends of the previous pier extension; also the formation of a dredged channel 16 feet deep, extending from the harbor entrance to the mouth of the canal, '80, 1907, 1908; '83, 279.

**Surveys.**

Survey made, 1890, under direction of Maj. Davis, '90, 2337.

**SUCARNOOCHEE RIVER, ALA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 221.

**ENGINEER IN CHARGE.**

Maj. A. N. Damrell, 1890. Report, '91, 1801.

**Plans.**

In 1890 Maj. Damrell reported that an improvement by removal of snags and similar obstructions would cost \$35,000, but did not recommend its commencement until the completion of more important improvements, '91, 1802.

Col. Comstock, division engineer, did not consider the locality worthy of improvement, '91, 1803.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Damrell, '91, 1801.



**SULLIVANS ISLAND.**—(See CHARLESTON HARBOR, S. C.)**SULLIVAN FALLS, HANCOCK COUNTY, ME.**—EXAMINATION OF.**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 33.

ENGINEER IN CHARGE.

Lieut. Col. J. A. Smith, 1890. Report, '91, 619.

**Physical Characteristics.**

Description of the locality, '91, 619.

**Plans.**

By Lieut. Col. Smith, 1890, for removal of rock ledges near the Sullivan shore or Falls Point, so as to produce a clear channel 150 feet wide and 10 feet deep at mean low water; estimated cost, \$35,000, '91, 33.

**SUMPAWANUS INLET, N. Y.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 510.)

**Appropriations.**

1881-'82 ..... \$7,000

List of appropriations, '88, 631.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 66; '89, 85; '90, 75; '91, 94; '92, 98.

ENGINEERS IN CHARGE.

Lieut. Col. W. McFarland, 1885-'89. Report, '88, 629.

Capt. T. L. Casey, 1889-'— Reports, '89, 817; '90, 841; '91, 978; '92, 863.

**Operations.**

1889-'92. No operations, '88, 629; '89, 817; '90, 841; '91, 978; '92, 864.

**Physical Characteristics.**

Description of the inlet, '88, 629.

**Plans.**

Lieut. Col. McFarland reports, in 1888, that the limited commerce of the inlet does not warrant the formation of more than a 5-foot channel, '88, 630.

**Projects.**

By Col. J. Newton, 1880, for improvement of the inlet by excavation of a 5-foot mean low-water channel from head of tide water to the bay; width of channel in inlet, 100 feet, and at the mouth, 150 feet; estimated cost, \$23,115, '81, 655; '92, 864.

**SUPERIOR BAY AND SAINT LOUIS BAY, WIS.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 510.)

**Appropriations.**

1873-'87 ..... \$491,050

1888..... 50,000, '88, 1811.

1890..... 65,000, '90, 2294.

1892..... 70,000, '92, 2136.

Total..... 676,050

List of appropriations, '88, 1810.

**Contracts.**

1888. C. S. Barker, for dredging, at 14½ cents per cubic yard, '89, 2013.

1891. C. S. Barker, for dredging, at 14 cents per cubic yard, '91, 2498.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 230; '89, 270; '90, 243; '91, 312; '92, 298.

ENGINEERS IN CHARGE.

Maj. J. B. Quinn, 1886-'91. Reports, '88, 1809; '89, 2010; '90, 2291.

Capt. W. L. Fisk, 1891-'—. Reports, '91, 2495; '92, 2132.

**SUPERIOR BAY AND SAINT LOUIS BAY, WIS.—Continued.****Operations.**

1887-'88. 32,473 cubic yards material dredged from channels and dock area, '88, 1810.

1888-'89. 75,700 cubic yards material dredged, '89, 2011.

1889-'90. 84,286 cubic yards material dredged, '90, 2292.

1890-'91. 110,375 cubic yards of material dredged, '91, 2496.

1891-'92. 165,875 cubic yards of material dredged, '92, 2134.

**Physical Characteristics.**

Description of the locality, '88, 1809; '89, 2010.

**Projects.**

By the Board of Engineers, 1881, for enlargement of harbor area and channel facilities by deepening to 16 feet the channel in entry between the piers, and from thence parallel to shore of Superior Bay, past the mouth of Nemadji River to Quebec Wharf, thence along west side of bay to an intersection with the channel of the Saint Louis River opposite Connors Point; also the deepening of Nemadji River for about half a mile; estimated cost of dredging, \$287,080; the preservation of existing piers by repair, at an estimated cost of \$25,000; estimated cost of entire project, \$312,080, '81, 270, 2024, 2028; '82, 2103. (Maj. Houston and Capt. Mackenzie and Allen.)

In 1884 Congress provided for deepening to 16 feet the channel of the Saint Louis River within Superior Bay, thereby adding \$33,000 to the original estimate for existing project, '85, 294, 1962; '86, 1633; '87, 1948.

In 1888 the estimated cost of \$345,080 was increased by \$114,156, for completion of the channel along the Wisconsin dock line in Saint Louis Bay, making the total required for completion of the extended project, in 1888, \$461,736, '88, 1810, 1811.

**Surveys.****MAPS.**

'90, 2292.

**SUSQUEHANNA RIVER, MD., above and below Havre de Grace.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 513.)

**Appropriations.**

1852-'87 .....	\$148,390
1888 .....	10,000, '88, 747.
1890 .....	4,000, '90, 935.
1892 .....	4,000, '92, 968.

Total ..... 166,390

List of appropriations, '88, 746.

**Commerce.**

Estimated value of, on the river, '88, 746.

**Contracts.**

1889. Baltimore Dredging Company, for dredging, at 16 cents per cubic yard, '89, 898.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 91; '89, 108; '90, 98; '91, 124, 132; '92, 124, 131.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1885.— Reports, '88, 746; '89, 896; '90, 934; '91, 1181; '92, 966, 994, 996.

**ASSISTANT.**

A. Stierle. Report, '92, 995.

**Operations.**

1887-'89. No operations for lack of funds, '88, 746; '89, 896.

1889-'90. 47,978 cubic yards material dredged, '90, 935.

1890-'92. No operations, '91, 1182; '92, 968.

**Physical Characteristics.**

Description of the river above Havre de Grace, '92, 995.

**Plans.**

By W. F. Smith, 1891, for improvement above Havre de Grace by deepening the shoal between the Pennsylvania, Wilmington and Baltimore Railroad Bridge, so as to enlarge the cross section of the river at that point, and constructing 8 piers at the Hog Back above Port Deposit to break up ice; estimated cost, \$425,109, '92, 998.

### SUSQUEHANNA RIVER, MD., above and below Havre de Grace—Continued.

#### Projects.

The original project of 1853 proposed the formation of a dredged channel 100 feet wide and 10 feet deep at mean low water between Havre de Grace and the mouth of the river; estimated cost, \$37,000, '80, 616.

In 1886, it having been found that the above-described dredged channel had largely refilled, Maj. Craighill proposed the use of a temporary floating deflector to train the current toward the line of the main channel, '67, 42, 419, 427; '80, 617.

In 1871 the floating deflector was replaced by a pile dike, '71, 590, 591; '80, 618.

In 1880 Maj. Craighill proposed the formation of a channel with a mean low-water depth of 12 feet between Havre de Grace and Spesutie Island; also dredging at Battery Light, and removal of cribs above Havre de Grace, '80, 621.

Since 1882 the dredged channel has been maintained by systematic dredging to a depth of about 12 feet below Havre de Grace and 8 feet through the shoal near Watsons Island; an ultimate depth of 15 feet is proposed below the bridge, '87, 92.

#### Surveys.

Survey of the river above Havre de Grace ordered by act of September 19, 1890.

Made, 1891, under direction of W. F. Smith, '92, 966.

### SUSQUEHANNA RIVER, PA.—EXAMINATION OF WEST BRANCH OF.

#### Engineers.

CHIEF OF ENGINEERS.

Report, '91, 118.

ENGINEER IN CHARGE.

Maj. C. W. Raymond, 1890. Report, '91, 1102.

#### Physical Characteristics.

Description of the West Branch, '91, 1103.

Navigation of the river, '91, 1104.

Floods, '91, 1105, 1107, 1109.

#### Plans.

In 1890 Maj. Raymond did not consider that the local nature of the interests involved warranted an expenditure such as would be requisite for the improvement desired, '91, 1113.

#### Surveys.

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Raymond, '91, 1102.

### SUWANEE RIVER, FLA.—IMPROVEMENT OF.

(Continued from Vol. II, p. 514.)

#### Appropriations.

1839-'87 .....	\$38,000
1888 .....	15,000, '88, 1121.
1890 .....	3,000, '90, 1613.
1892 .....	3,000, '92, 1396.

Total ..... 59,000

List of appropriations, '89, 1349.

#### Commerce.

Improvement of the river essential to the development of commerce, '88, 1121.

#### Engineers.

CHIEF OF ENGINEERS.

Reports, '88, 150; '89, 173; '90, 155; '91, 194; '92, 191.

ENGINEERS IN CHARGE.

Capt. W. M. Black, 1886-'92. Reports, '88, 1118; '89, 1349; '90, 1611; '91, 1663.

Maj. J. C. Mallery, 1892-'—. Report, '92, 1393.

#### Obstructions.

Obstruction of the river by sawmill refuse, '88, 1121.

#### Operations.

1887-'88. 1,515 cubic yards rock blasted and removed from the channel, '88, 1119, 1120.

**SUWANEE RIVER, FLA.—Continued.****Operations—Continued.**

1888-'89. 283 cubic yards material dredged; 265 cubic yards rock blasted and 74 cubic yards removed from the channel; 76 trees cut and trimmed on the banks, '89, 1351.

1889-'90. 135 trees and 1,900 cubic yards brush cut from the banks; 19 snags and logs, 611 cubic yards rock, and 150 cubic yards sand removed from the channel, and 331 cubic yards rock blasted, '90, 1613.

1890-'91. Logs, snags, and 526 cubic yards of rock removed; repairs to snag boat, '91, 1665.

1891-'92. 261 cubic yards of rock blasted and 561 cubic yards removed; 607 cubic yards of material dredged, '92, 1395.

**Physical Characteristics.**

Description of the river, '90, 1611.

**Projects.**

By Maj. Damrell, 1879, for improvement of the Suwanee River from its mouth to Rolands Bluff, a distance of 74 miles, by the formation of a 5-foot channel 150 feet wide; thence to Ellaville, a distance of 50 miles, a channel 4 feet deep and 60 feet wide, to be established by snag and rock removal, dam construction, and dredging; estimated cost, \$55,158, '79, 857, 862, 863; '86, 1143; '92, 1394.

**SWANTON HARBOR, VT.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 515.)

**Appropriations.**

1873-'82 ..... \$70,500

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 287; '89, 343.

ENGINEER IN CHARGE.

Maj. M. B. Adams, 1885— Reports, '88, 2094; '89, 2455.

**Operations.**

1887-'89. No operations, '88, 2095; '89, 2455.

**Plans.**

In 1888 Maj. Adams recommended that no further appropriations be made until the development of the shipping interests indicate in what direction improvement is desired, '88, 2095.

In 1889, after examination, Maj. Adams reported the locality as at present unworthy of further improvement, '89, 2458.

**Projects.**

By Lieut. Col. Newton, 1873, for the construction of a breakwater of crib work filled with stone, for the protection of the docks and wharves at Swanton; estimated cost, \$272,600, '73, 397, 398; '74, i, 275. Reduced to \$240,000, '79, 397; '82, 710.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Adams, '88, 2095.

**SWIFT CREEK, N. C.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 148.

ENGINEER IN CHARGE.

Capt. W. H. Bixby, 1888. Report, '89, 1116.

**Physical Characteristics.**

Description of the locality, '89, 1117.

**Plans.**

In 1889 Capt. Bixby did not consider the creek worthy of improvement, '89, 1116.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1116.

**SWINOMISH SLOUGH, WASH.—SURVEY FOR SHIP CHANNEL THROUGH.****Appropriations.**

1892..... \$25,000

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 411; '92, 384.

ENGINEER IN CHARGE.

Capt. T. W. Symons, 1890. Report, '92, 2752, 2753.

ASSISTANT.

J. R. Savage. Report, '92, 2759.

**Physical Characteristics.**

Description of the locality, '92, 2756.

**Plans.**

By Capt. Symons, 1891, for excavation of a channel 100 feet wide and 4 feet deep in Swinomish Slough and across the flats at its northern and southern entrances to a sufficient depth of water in Padilla Bay and Skagit Bay, forming a basin near Goat Island by widening the channel to 200 feet for a length of 750 feet, and construction of dikes where necessary for the protection of the cut; estimated cost, \$122,000, '92, 2756.

**Surveys.**

Ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '92, 2753.

**TALLAHATCHEE RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 516.)

**Appropriations.**

1879-'87..... \$27,500

1888..... 5,000, '88, 1364.

1890..... 5,000, '90, 1899.

1892..... 5,000, '92, 1650.

Total ..... 42,500

List of appropriations, '88, 1363.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 182; '89, 213; '90, 192; '91, 244; '92, 236.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1887-'—. Reports, '88, 1363; '89, 1613; '90, 1897; '91, 2003; '92, 1648.

**Operations.**

1887-'88. No operations for lack of funds, '88, 1363.

1888-'89. 265 snags and logs removed from the channel, '89, 1614.

1889-'90. 424 snags and logs and 3 wrecks removed from the channel, and 12,920 trees and 435 square yards brush cleared from the banks, '90, 1899.

1890-'91. 302 snags and 53 logs removed from the channel, and 417 shore snags, 2,902 trees, and 95 square yards of brush cleared from the banks, '91, 2004.

1891-'92. 398 snags and 2 wrecks removed from the channel, '92, 1650.

**Projects.**

By Maj. Benyaure, 1879, for improvement of the low-water navigation of the river from its junction with the Cold Water River to the mouth, a distance of 165 miles, by removal of snags, trees, and the wreck of a steamer; estimated cost, \$40,000, '79, 116, 971, 985; '87, 200, 1774. Improvement not considered permanent, '88, 1363.

**TALLAPOOSA RIVER, ALA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 517.)

**Appropriations.**

1882-'87..... \$32,500

1888..... 7,500, '88, 1185.

1890..... 4,000, '90, 1651.

Total ..... 44,000.

List of appropriations, '88, 1184.

**TALLAPOOSA RIVER, ALA.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 156; '89, 182; '90, 165; '91, 206; '92, 201.

**ENGINEERS IN CHARGE.**

Capt. R. L. Hoxie, 1885-'89. Report, '88, 1184.

Capt. P. M. Price, 1889-'—. Reports, '89, 1396; '90, 1649; '91, 1741; '92, 1423.

**ASSISTANT.**

C. B. Percy. Reports, '89, 1398; '90, 1650; '92, 1423.

**Operations.**

1887-'88. 2,510 logs and snags and 41 cubic yards marl removed from the channel, and 214 overhanging trees cut from the banks, '88, 1185.

1888-'89. 2,124 logs and snags removed from the channel, and 4,293 overhanging trees from the banks, '89, 1398.

1889-'90. 1,184 logs and snags and 1 sunken ferryboat removed from the channel, 564 overhanging trees cut from the banks, '90, 1650.

1890-'91. No operations, '91, 1742.

1891-'92. 185 snags removed from the channel, and 57 trees cleared from the banks, '92, 1423.

**Physical Characteristics.**

Character of the river bottom and banks, '89, 1397; '90, 1694.

**Projects.**

By Maj. Damrell, 1881, for improvement of the Tallapoosa River from the foot of Tallassee Reefs to its mouth, a distance of 48 miles, giving a 3-foot channel with a 60-foot width in soft rock cuts, and 200 feet in open river, by removal of snags, logs, and similar obstructions, bank protection, dike and wing-dam construction, and gravel and soft rock excavation; estimated cost, \$40,125, '81, 1230;

'87, 1285. Up to 1890 \$44,000 was expended upon this improvement over the original estimate, being due to insufficient appropriations, '90, 1649.

**TAMPA BAY, FLA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 517.)

**Appropriations.**

1880-'87 .....	\$70,000
1888.....	25,000, '88, 1114.
1890.....	25,000, '90, 1605.
1892.....	10,000, '92, 1388.

Total ..... 130,000

List of appropriations, '89, 1343.

**Contracts.**

1888. D. G. Ambler, for dredging, at 29 cents per cubic yard, '89, 1344.

1891. Alabama Dredging and Jetty Company, for dredging, at 25 cents per cubic yard, '91, 1657.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 148; '89, 171; '90, 153; '91, 192; '92, 189.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1888-'92. Reports, '88, 1112; '89, 1342; '90, 1604; '91, 1655.

Maj. J. C. Mallory, 1892-'—. Report, '92, 1386.

**Operations.**

1887-'88. 473 cubic yards rock removed, and 7,250 cubic yards material dredged from the channel, '88, 1113.

1888-'89. No operations, '89, 1344.

1889-'90. 14,688 cubic yards material dredged, '90, 1605.

1890-'91. 48,771 cubic yards material dredged, '91, 1656.

1891-'92. 52,664 cubic yards material dredged, '92, 1388.

**Physical Characteristics.**

Description of the bay, '88, 1112; '89, 1342.

**Projects.**

By Lieut. Col. Damrell, 1879, for improvement of Tampa Bay by deepening the present channel from Ballast Point to Tampa, a distance of  $5\frac{1}{2}$  miles, by dredging and rock removal to 9 feet, with 200 feet width in the river and 150 feet in the bay; estimated cost, \$97,000, '79, 871; '80, 1077. Increased in 1886 and 1887 to \$133,000, '86, 1189; '87, 1245.

**TAMPA BAY, FLA.—Continued.****Projects—Continued.**

This project was modified in 1888 by Capt. Black, to provide for the formation and maintenance of a channel 8 feet deep in Hillsborough Bay and Hillsborough River to the city of Tampa, and the formation of a channel 200 feet wide and 20 feet deep at mean low water from the outer bar to Port Tampa; estimated cost, \$60,000, '90, 1805; '92, 1887.

**Surveys.****MAPS.**

'88, 1112.

**TAMPA BAY AND OLD TAMPA BAY, FLA.—EXAMINATION OF CHANNEL BETWEEN.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 175.

**ENGINEER IN CHARGE.**

Capt. W. M. Black, 1888. Report, '89, 1368.

**Physical Characteristics.**

Description of the locality, '89, 1368.

**Plans.**

By Capt. Black, 1889, for improvement of the waterway connecting Tampa and Old Tampa bays by excavation of a channel 200 feet wide and 20 feet deep at mean low water across the bars, '89, 1369.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. W. M. Black, '89, 1369.

**TANGIER HARBOR, VA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 131, 1207.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1891. Report, '91, 1207.

**ASSISTANT.**

A. Stierle. Report, '91, 1208.

**Physical Characteristics.**

Description of the locality, '91, 1208.

**Plans.**

In 1891 Mr. Smith did not consider the locality worthy of improvement, '91, 1208.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of W. F. Smith, '91, 1207.

**TANGIPAHOA RIVER, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 518.)

**Appropriations.**

1872-'84 ..... \$11,500

**Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 202.

**ENGINEER IN CHARGE.**

Capt. W. L. Fisk, 1888-'—. Reports, '88, 1245; '89, 1527.

**Operations.**

1887-'89. No operations for lack of funds, '88, 1246; '89, 1529.

**Physical Characteristics.**

Description of the river, '89, 1527.

**TANGIPAHOA RIVER, LA.—Continued.****Plans.**

In 1888 Capt. Fisk reported the improvement as purely local in its benefits, '88, 1245.  
By Capt. Fisk, 1889, for improvement of the river by removal of snags and similar obstructions, giving a permanent low-water depth of 3 feet, at an estimated cost of \$5,000, '89, 1527.

**Projects.**

The appropriation of \$2,500 of 1872 was applied to the removal of snags and other obstructions, '73, 64, 631.

By Maj. Howell, 1879, for improvement of the Tangipahoa River from its junction with the Amite to its mouth, a distance of 53 miles, by removal of snags, logs, trees, and similar obstructions; estimated cost, \$10,700, '79, 946, 949; '86, 1241; '88, 1245.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Fisk, '89, 1527.

**TAR RIVER from Tarboro to Rocky Mount, N. C.—EXAMINATION OF.**

(Continued from Vol. II, p. 519.)

**Commerce.**

Reduction in freight charges due to improvement, '89, 1131.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 148.

ENGINEER IN CHARGE.

Capt. W. H. Bixby, 1888. Report, '89, 1130.

**Physical Characteristics.**

Description of the locality, '89, 1130.

**Plans.**

By Capt. Bixby, 1889, for removal of snags, logs, and similar obstructions from Tarboro up to Rocky Mount Little Falls; estimated cost, \$16,200, '89, 1131.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1130.

**TARRYTOWN, N. Y.—EXAMINATION OF HUDSON RIVER AT.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 83.

ENGINEER IN CHARGE.

Lieut. Col. G. L. Gillespie, 1888. Report, '89, 800.

**Plans.**

In 1888 Lieut. Col. Gillespie did not consider the existing commercial requirements such as to warrant any improvement of the harbor, '89, 800.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Gillespie, '89, 800.

**TAUNTON RIVER, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 519.)

**Appropriations.**

1870-'84 .....	\$157,000
1890 .....	7,000, '90, 564.
1892 .....	7,000, '92, 615.

Total .....	171,000
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**TAUNTON RIVER, MASS.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 37, 44; '89, 47, 55; '90, 42; '91, 53; '92, 57.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. H. Elliot, 1882-'89. Report, '88, 515.

Maj. W. R. Livermore, 1887-'92. Reports, '88, 492, 517; '89, 618, 647; '90, 563; '91, 707.

Capt. W. H. Birby, 1892-'—. Report, '92, 613.

**Operations.**

1887-'88. Channel completed under outstanding contracts as projected, '88, 493.

1888-'90. No operations, '89, 619; '90, 564.

1890-'91. Dredging by hired labor, '91, 708.

1891-'92. 2,650 cubic yards material dredged, '92, 615.

**Physical Characteristics.**

Description of the locality, '88, 515, 516.

**Projects.**

The project of 1871 proposed the formation of a channel, by dredging, 9 feet deep at high water through the shoals between Dighton and Weir Village; estimated cost, \$54,400, '71, 94, 891.

The project for this improvement in 1880 had as its object to secure a navigable depth at high water of 11 feet and a width of 60 feet from Weir Bridge to Shipyard, 80 feet wide and 11 feet deep to the Needles; thence to Berkley Bridge same width and 12 feet depth, and from Berkley Bridge to Dighton 100 feet width and 12 feet depth; estimated cost, \$94,000, '80, 376; '86, 595.

In 1888 Maj. Livermore proposed the continuation of the improvement by widening the 80-foot channel to its full dimensions where too narrow; the removal of bowlders obstructing the channel between Berkley Bridge and Taunton; also removal of ledge rock in the channel below Peters Point; estimated cost, \$14,051, '88, 518.

This additional project increased the total estimate to \$108,000 in 1889, '89, 619; '92, 614.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1887, under direction of Maj. Livermore, '88, 517; '89, 647.

**TCHEFUNCTE RIVER AND BOGUE FALIA (FALAYA), LA.—  
IMPROVEMENT OF.**

(Continued from Vol. II, p. 520.)

**Appropriations.**

1872-'87 .....	\$11,500
1890 .....	1,000, '90, 1738.
1892 .....	1,000, '92, 1483.

Total ..... 13,500

List of appropriations, '92, 1482.

**Commerce.**

Capt. Fisk reports the benefit of the improvement as local, '88, 1244.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 167, 217; '89, 194, 202; '90, 175; '91, 222; '92, 215.

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1243; '89, 1482, 1529; '90, 1737.

Capt. J. H. Willard, 1889. Report, '89, 1628.

Maj. J. B. Quinn, 1891-'—. Reports, '91, 1818; '92, 1481.

**ASSISTANT.**

D. M. Marshall. Report, '89, 1628.

**Operations.**

1887-'91. No operations. '88, 1243; '89, 1482; '90, 1737.

1891-'92. 161 snags and 102 logs removed from the channel, and 143 trees cleared from the banks, '92, 1482.

**Plans.**

Capt. Fisk, 1889, reported that beyond the annual appropriation of \$1,000 for snagging, etc., the Tchefuncte and Bogue Falia were unworthy of improvement on account of the large cost relatively to the value of the commerce to be benefited, '89, 1530.

**TCHEFUNCTE RIVER AND BOGUE FALIA (FALAYA), LA.—**  
Continued.**Plans—Continued.**

In 1889 Capt. Willard did not consider the Bogue Falia worthy of improvement, '89, 1629.

**Projects.**

The appropriation of \$6,000 in 1872 was applied to the removal of the wreck of the gunboat *Oregon*, '73, 65, 634.

By Maj. Howell, 1880, for improvement of the Tchefuncte River by removal of snags and similar obstructions from the mouth to Covington and dredging on bar at entrance to Lake Pontchartrain; estimated cost, \$5,460, '80, 1182.

By Maj. Stickney, 1884, for formation of a channel across the bar 100 feet wide and 7 feet deep by dredging and the construction of 2,500 linear feet of break-water; estimated cost, \$20,400, '84, 1270.

In 1889 Capt. Fisk, after examination, reported the Tchefuncte and Bogue Falia as unworthy of any improvement beyond the annual appropriation of \$1,000 for snagging, '89, 1530.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Willard, '89, 1628.

**TCHULA LAKE, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 520.)

**Appropriations.**

1881-'87 .....	\$9, 000
1888 .....	3, 000, '88, 1362.
1890 .....	3, 000
1892 .....	3, 000, '92, 1647.

Total ..... 18, 000

List of appropriations, '90, 1897.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 181; '89, 213; '90, 192; '91, 244; '92, 236.

**ENGINEER IN CHARGE.**

Capt. J. H. Willard, 1887-'—. Reports, '88, 1361; '89, 1612; '90, 1896; '91, 2001; '92, 1645.

**Operations.**

1887-'88. No operations, '88, 1361.

1888-'89. 104 snags removed from the channel; 1,320 trees and 125 square yards brush cleared from the banks, '89, 1612.

1889-'90. No operations, '90, 1897.

1890-'91. 70 snags and 3 log jams removed from the channel, and 884 trees and 660 square yards of brush cleared from the banks, '91, 2001.

1891-'92. 340 snags removed from the channel, and 1,624 trees girdled; 1,833 leaning trees cut; 2,743 logs and shore snags removed, and 56,735 square yards brush cut, '92, 1646.

**Projects.**

By Maj. Benyaard, 1879, for improvement of Tchula Lake from Honey Island to its junction with the Yazoo, a distance of 80 miles, by removal of logs, snags, and similar obstructions; estimated cost, \$10,000, '80, 1351.

The improvement not considered permanent, '86, 234.

**TENNESSEE RIVER above and below Chattanooga, Tenn.—**  
IMPROVEMENT OF.

(Continued from Vol. II, p. 521.)

**Appropriations.****BELOW CHATTANOOGA.**

1827-'87 .....	\$2, 960, 551. 94
1888 .....	250, 000. 00, '88, 1600.
1890 .....	475, 000. 00, '90, 2126.
1892 .....	500, 000. 00, '92, 1951.

Total ..... 4, 235, 551. 94

**TENNESSEE RIVER above and below Chattanooga, Tenn.—**  
Continued.

**Appropriations—Continued.**

**ABOVE CHATTANOOGA.**

1852-'87 .....	\$276,000.00
1888 .....	15,000.00, '88, 1593.
1890 .....	30,000.00, '90, 2113.
1892 .....	25,000.00, '92, 1914.

Total..... 346,000.00

List of appropriations for improvement below Chattanooga, '91, 1951.

List of appropriations for improvement above Chattanooga, '92, 1913.

**Commerce.**

Commerce of the Upper Tennessee; prospective advantages to be derived from completion of improvement, '88, 1593; '89, 1822, 1829.

List of steamers plying above Chattanooga, '92, 1918.

**Contracts.**

1891. W. Kirk, for pile and stone dike construction, at a total of \$14,555, '92, 2258.  
Neely & Smith, for rock removal, at \$1.75 per ton, '92, 1947.

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '88, 207; '89, 241; '90, 216; '91, 278, 279, 286, 287; '92, 266, 267, 273, 275.

**BOARD OF ENGINEERS.**

Convened at Nashville, Tenn., October 22, 1890, by S. O. No. 83, to report upon a project for removal of obstructions in the Tennessee River, known as the "Suck." Report, '91, 2313. (Lieut. Col. Barlow and Majs. Mackenzie and Adams.)

Convened at Nashville, Tenn., October 23, 1890, by S. O. No. 83, to report as to what changes and additions are required in the Muscle Shoals Canal system. Report, '92, 2314. (Lieut. Col. Barlow and Majs. Mackenzie and Adams.)

Convened at Nashville, Tenn., October 28, 1890, by S. O. No. 83, to report upon improvement of Colbert and Bee Tree shoals. Report, '91, 2317. (Lieut. Col. Barlow and Majs. Mackenzie and Adams.)

**ENGINEERS IN CHARGE.**

Lieut. Col. J. W. Barlow, 1886-'92. Reports, '88, 1591; '89, 1819; '90, 2111; '91, 2252, 2255.

Capt. G. W. Goethals, 1891-'92. Reports, '91, 2303, 2311, 2322; '92, 1495, 1956.

Lieut. Col. H. M. Robert, 1892-'—. Report, '92, 1911.

**ASSISTANTS.**

W. A. McFarland. Reports, '91, 2307; '92, 1954.

D. L. Sublett. Report, '92, 1951.

W. G. Williamson. Report, '92, 1953.

**Legislation.**

Act of April 6, 1889, legislature of Tennessee, fixing the source and extent of the Tennessee River, '89, 1820.

**Obstructions.**

List of bridges over the Tennessee River, '89, 1828; '90, 2125.

**Operations.**

**ABOVE CHATTANOOGA.**

1887-'88. 140 linear feet of riprap dam built; 788 cubic yards riprap quarried, and 30 cubic yards loose rock removed; 127 snags removed, and 103 trees cut from the banks, '88, 1593.

1888-'89. 577 cubic yards riprap quarried and placed in dams at White Creek Shoals; 42 snags removed, and 1,872 trees cut from the banks, '89, 1821.

1889-'90. 3,900 cubic yards stone quarried and built into dams, and 510 snags removed from the channel, '90, 2113.

1890-'91. White Creek Island Dam extended 690 feet, and 345 linear feet of spur dam built; 40 cubic yards rock and 24 snags removed from the channel, and 258 overhanging trees cleared from the banks, '91, 2254.

1891-'92. Lower dam repaired and raised throughout a length of 1,600 feet; upper dam at tow-head, and spur dam on reef repaired; repairs to plant, '92, 1914.

**BELOW CHATTANOOGA.**

1887-'88. 3,315 cubic yards solid rock, 750 cubic yards loose rock, sand, and gravel, and 48,706 cubic yards earth excavated; 246 cubic yards stone quarried; 2,546 cubic yards masonry laid, and 2,465 cubic yards of riprap and cofferdam built; miscellaneous work upon maneuvering gear at Big Muscle and Elk River shoals, '88, 1595, 1597.

**TENNESSEE RIVER above and below Chattanooga, Tenn.—**  
Continued.

**Operations—Continued.**

**BELOW CHATTANOOGA—Continued.**

1888-'89. 37,000 cubic yards material excavated and placed in embankments; 2,313 cubic yards dimension stone and riprap quarried; 4,573 cubic yards rubble masonry laid at Big Muscle Shoals; 7,373 cubic yards material dredged; 425 cubic yards riprap stone quarried, and 489 cubic yards masonry laid; 8,000 cubic yards material placed in dams at Elk River Shoals, '89, 1825, 1826.

1889-'90. 24,000 cubic yards earth and rock excavated, 12,000 cubic yards embankment built, 2,900 cubic yards dimension and riprap stone quarried, and 2,400 cubic yards rubble masonry laid at Big Muscle Shoals Canal; 17,820 cubic yards earth excavated, 1,284 cubic yards riprap quarried, and 5,600 cubic yards cut stone and rubble masonry placed at Elk River Shoals Canal, '90, 2117, 2118.

1890-'91. 934 cubic yards of stone and 210 cords of brush used in bank protection at Livingstone Point; 358 piles, 1,124 cubic yards stone, and 303 cords of brush used in dike construction, '91, 2256, 2257. Drift sluice built in Browns Island Dam, Elk River division, '91, 2305. Dam across Second Creek, on the Muscle Shoals division, extended 30 feet; new abutment built; 9,000 cubic yards material dredged from the levels of Lock 7; remains of cofferdam below Lock 9 removed; lock houses at locks 1, 6, and 7 completed, and in progress at locks 3 and 4, '91, 2305, 2306. Operation and care of Muscle Shoals Canal, '91, 2322.

1891-'92. Pile and stone dike shore protection completed at Livingstone Point under contract, '92, 1917. 8,083 cubic yards of rock and 3,793 trees removed from Tumbling Shoals and Sack Point, '92, 1947. Drift sluice above Lock A completed; lock houses completed at Lock A; 20,500 cubic yards material excavated from channel below Lock B, '92, 1948. Gap at inner end of wing dam at head of canal closed; 5 miles of railway built along the towpath, '92, 1949. Operation and care of Muscle Shoals Canal, '92, 1956.

**Physical Characteristics.**

Description of the river, '88, 1591, 1592.

Surface velocity of current at different readings of gauge at head of Tumbling Shoals, Tennessee River, '92, 1953.

Statement showing difference in feet between high and low water at important points between Chattanooga and Bridgeport, '92, 1953.

**Projects.**

**ABOVE CHATTANOOGA.**

By Maj. McFarland, 1871, for an improved channel to a depth of 3 feet at low water between Chattanooga and Knoxville, a distance of 189 miles, and requiring the removal of 29 obstructing reefs and shoals; estimated cost, \$175,000, '71, 502, 507; '77, 579. Increased in 1887 to \$225,000, '79, 1248; '80, 1669; '81, 1841; '87, 1738.

In 1890, after an expenditure of \$271,000, \$29,000 was estimated as required for completion of the projected improvement, '90, 2113, 2114.

**BELOW CHATTANOOGA.**

The projects of 1872-'77 proposed the improvement of about 456 miles of river by the construction of a canal 14½ miles long, 70 to 120 feet wide, and 6 feet deep around Muscle Shoals; a canal 1½ miles long, around Elk River Shoals; in blasting a channel through the bed rock, and construction of wing dams at Little Muscle Shoals, and in removing the obstructions above Decatur and below Florence; estimated cost, \$4,133,000, '70, 389; '73, 544; '77, 1,584; '86, 1510, 1513; '87, 1740.

By Board of Engineers, 1890, for improvement of Little Muscle Shoals by construction of a canal around the shoals, and continuation of the same to the Florence Bridge; estimated cost, \$3,037,000, '91, 2316.

By Board of Engineers, 1890, for improvement of Colbert and Bee Tree shoals by construction of a canal around the shoals on the south bank of the river; estimated cost, \$2,500,000, '91, 2321.

**Surveys.**

Survey of Browns Island Chute. Made, 1888, under direction of Lieut. Col. Barlow, '88, 1598.

**MAPS.**

'90, 2126; '92, 2321.

8648—29

**TENSAS RIVER AND BAYOU MACON, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 523.)

**Appropriations.**

1881-'87 .....	\$11,000
1888.....	5,000, '88, 1356.
1890.....	5,000, '90, 1889.
1892.....	5,000, '92, 1619.

Total ..... 26,000

List of appropriations, '92, 1617.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 180; '89, 211; '90, 190; '91, 241; '92, 233.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1887-'— Reports, '88, 1354; '89, 1605; '90, 1888; '91, 1989; '92, 1617.

**Operations.**

1887-'88. 330 snags removed from the channel, and 392 shore snags and leaning trees cleared from the banks, '88, 1355.

1888-'89. 1,939 snags and logs removed from the channel, and 5,480 trees from the banks, '89, 1605.

1889-'91. No operations, '90, 1888; '91, 1990.

1891-'92. 875 snags, 1,512 stumps, and 1,450 short snags removed, and 2,398 trees and logs cleared from the banks, '92, 1619.

**Projects.**

By Maj. Benysaurd, 1880, for the removal of snags, logs, and similar obstructions from the mouth to Dallas, a distance of 180 miles; estimated cost, \$23,000, '81, 1457, 1461. Also the removal of the same class of obstructions in Bayou Macon from Floyd to its mouth, about 130 miles, at an estimated cost of \$17,000, '88, 1355; '92, 1617.

**THAMES RIVER, CONN.—IMPROVEMENT OF.**

(See also NEW LONDON HARBOR, CONN.)

(Continued from Vol. II, p. 524.)

**Appropriations.**

1821-'87 .....	\$306,800
1888.....	50,000, '88, 525.
1890.....	20,000, '90, 603.
1892.....	30,000, '92, 655.

Total ..... 406,800

List of appropriations, '88, 524; '90, 603.

**Contracts.**

1888. Hartford Dredging Company, for dredging, at 19 cents per cubic yard, '88, 525.

1889. Hartford Dredging Company, for dredging, at 15.7 cents per cubic yard, '89, 658. E. Brainard, for dredging, at 18.9 cents per cubic yard, '89, 658.

1890. S. &amp; E. Belden, for furnishing riprap stone, at 96 cents per ton, and flat stone, at \$1.13 per ton, '90, 603.

1891. E. Brainard, for dredging, at 24½ cents per cubic yard, '91, 745.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 45; '89, 56; '90, 51; '91, 63; '92, 67.

ENGINEER IN CHARGE.

Col. D. C. Houston, 1886-'— Reports, '88, 521; '89, 654; '90, 600; '91, 742; '92, 652.

**Operations.**

1887-'88. 6,542 tons of stone delivered, completing 1,513 linear feet of dike; 37,953 cubic yards material dredged, '88, 523.

1888-'89. 222,392 cubic yards material dredged, '89, 656.

1889-'90. 50,421 cubic yards material dredged; 894 tons stone and 247 tons riprap delivered, '90, 601, 602.

1890-'91. 28,414 cubic yards material dredged, '91, 744.

1891-'92. 73,419 cubic yards material dredged, '92, 654.

**Projects.**

In 1821 obstructions placed in the river during the war of 1812 were removed, '79, 333.

**THAMES RIVER, CONN.—Continued.****Projects—Continued.**

The first definite project for improving the river was that of 1836, which proposed, by dredging and the construction of wing dams, to provide a channel 100 feet wide and 14 feet deep at high water; the desired results were obtained, but the shoals subsequently re-formed, '73, 983; '86, 630.

The project of 1866 proposed the re-formation, by dredging, of a channel 100 feet wide and 14 feet deep at high water across the bars below Norwich; estimated cost, \$65,000, '66, iv, 197; '68, 752; '73, 983.

In 1878 the project was modified to provide for a channel 100 feet wide and 14 feet deep at low water from Indian Point to Norwich; estimated cost, \$75,000, '78, 395, 398. Increased in 1880, for removal of Middle Grounds at Norwich, to \$101,000, '80, 442.

In 1882 the project was further modified so as to provide for increasing the width of the channel to 200 feet over the first  $3\frac{1}{4}$  miles below Norwich, together with the construction of training walls if necessary for the rectification of the river; estimated cost, \$208,080, '82, 603; '87, 582.

In 1888 the project was further extended to secure, by dredging, a 16-foot channel up to Allyna Point, and a 14-foot channel from Allyna Point to the end of the existing improvement; this increased the total estimated cost to \$248,280, making the present, 1889, estimate for completion \$95,600, and increasing the estimated cost for annual maintenance to \$8,000, '89, 655; '92, 654.

**Surveys.****MAPS.**

'89, 656.

**THOROUGHFARE between Cape May and Great Bay, N. J.—****SURVEY OF.****Commerce.**

Commerce to be benefited by improvement, '88, 728, 729.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 86; '91, 118.

**ENGINEERS IN CHARGE.**

Lieut. Col. H. M. Robert, 1888. Report, '88, 724, 730.

Maj. C. W. Raymond, 1891. Report, '91, 1097.

**ASSISTANT.**

L. Y. Schermerhorn. Report, '88, 725, 731.

**Physical Characteristics.**

Description of the locality, '88, 724, 726; '91, 1097.

**Plans.**

By Lieut. Col. Robert, 1888, for excavation of a channel 50 feet wide and 6 feet deep at mean low water throughout the length of the thoroughfare running back of the ocean from Cape May to Great Bay, N. J., involving the removal of 1,310,000 cubic yards of material, at an estimated cost, if done by contract, of \$200,000; or, if done by hired labor, of \$130,000, '88, 731.

After examination in 1890 Maj. Raymond did not consider that the commercial interests, present or prospective, warranted the expenditure involved in the improvement, '91, 1098.

**Surveys.**

Made, 1888, under direction of Lieut. Col. Robert, '88, 730.

**MAPS.**

'88, 734.

**THUNDER BAY, MICH.—(See ALPENA HARBOR.)****TICKFAW RIVER, LA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 525.)

**Appropriations.**

1881-'87 .....	\$6,000
1888.....	1,000, '88, 1246.
1890.....	1,000, '90, 1740.
1892.....	1,000, '92, 1485.

Total ..... 9,000

List of appropriations, '92, 1484.

**TICKFAW RIVER, LA.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 167; '89, 195, 202; '90, 176; '91, 222; '92, 216.

**ENGINEERS IN CHARGE.**

Capt. W. L. Fisk, 1888-'91. Reports, '88, 1246; '89, 1483, 1530; '90, 1739.

Maj. J. B. Quinn, 1891-'—. Reports, '91, 1819; '92, 1484.

**Operations.**

1887-'88. Snags and obstructions removed, '88, 1246.

1888-'89. Removal of obstructions with United States plant continued, '89, 1483.

1889-'91. No operations, '90, 1739.

1891-'92. 83 snags and 14 logs removed from the channel, and 103 trees cleared from the banks, '92, 1484.

**Plans.**

After examination in 1889 Capt. Fisk did not consider the stream worthy of improvement beyond that contemplated in the existing project, '89, 1531.

**Projects.**

By Maj. Howell, 1880, for improvement of the Tickfaw River from Van Buren Place to Natalbany and Ponchatoula River, a distance of 45 miles, by removal of snags, logs, and similar obstructions; estimated cost, \$10,230, '80, 1184; '92, 1484.

**TICONDEROGA RIVER, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 526.)

**Appropriations.**

1881-'87 .....	\$12,000
1888 .....	2,500, '88, 2102.
1890 .....	2,000, '90, 2883.

Total .....	16,500
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 289; '89, 342; '90, 309; '91, 387; '92, 365..

**ENGINEER IN CHARGE.**

Maj. M. B. Adams, 1885-'—. Reports, '88, 2101; '89, 2451; '90, 2882; '91, 2936; '92, 2613.

**Operations.**

1887-'88. 10,870 cubic yards material dredged, '88, 2101.

1888-'89. 15,418 cubic yards material dredged, '89, 2451.

1889-'91. No operations, '90, 2882.

1891-'92. 8,132 cubic yards material dredged, '92, 2613.

**Projects.**

By Lieut. Col. Michler, 1880, for improvement of Ticonderoga River by excavation of a channel 100 feet wide and 8 feet deep from the 8-foot curve in Lake Champlain to the railroad bridge, thence 60 feet to the foot of the falls at Ticonderoga; also to widen the channel in front of Cassey and Bishops docks to 100 feet and to extend a cut 100 feet wide diagonally across the basin; estimated cost, \$42,516, '81, 728, 729; '92, 2613.

**TILLAMOOK BAY AND BAR, OREG.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 526.)

**Appropriations.**

1888 .....	\$5,200, '88, 300.
1890 .....	500, '90, 2980.
1892 .....	15,000, '92, 2702.

Total .....	20,700
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**Commerce.**

Commercial interests of Tillamook Bay, '91, 3201.

**Contracts.**

1889. R. L. Hall, for brush and stone dike construction, at \$2 per running foot, '89, 2522.

**TILLAMOOK BAY AND BAR, OREG.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 300; '89, 357; '90, 321; '91, 404, 411; '92, 377, 384.

**ENGINEERS IN CHARGE.**

Capt. W. Young, 1888-'90. Reports, '88, 2150, 2152; '89, 2522.

Capt. T. W. Symons, 1890-'—. Reports, '90, 2979; '91, 3200; '92, 2701, 2742, 2744.

**ASSISTANTS.**

Lieut. E. Burr. Report, '88, 2151.

W. H. Wood. Report, '91, 3201.

A. J. McMillan. Report, '92, 2743, 2746.

J. R. Savage. Report, '92, 2751.

**Operations.**

1887-'89. No operations, '88, 2152; '89, 2522.

1889-'90. 1,148 linear feet of sheet pile dike and 448 linear feet of pile and brush revetment built at Dry Stocking Bar, '90, 2979.

1890-'92. No operations, '91, 3200; '92, 2701.

**Physical Characteristics.**

Description of the locality, '88, 2152.

**Plans.**

By Capt. Symons, 1891, for forming a connection between the north and middle channels above Bay City by dredging a channel 200 feet wide and 6 feet deep at low water; construction of a dike along the west side of this channel, and extending across the middle channel, so as to direct the current through the out; construction of a dike to close the south channel and to turn its current into the middle channel, and closing by a dike one of the channels at the outlet to Hoquarton Slough; estimated cost, \$100,000, '92, 2745, 2746.

**Projects.**

By Capt. Powell, 1888, for dredging, removal of snags and similar obstructions, and closing with brush and stone dams two small outlets, giving a depth of 3 feet over Dry Stocking Bar at mean high tide; estimated cost, \$5,192.19, '88, 2153.

In 1890, the unfinished work under the prior project having been destroyed, Capt. Symons estimated the cost of longitudinal and spur dikes and shore protection, to deepen the water across Dry Stocking Bar, at \$6,000, '90, 2980.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1888, under direction of Capt. Powell, '88, 2152.

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Symons, '92, 2744.

**TIONESTA CREEK, PA. EXAMINATION OF.**

(Continued from Vol. II, p. 526.)

**Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 294.

**ENGINEER IN CHARGE.**

Lieut. Col. W. E. Merrill, 1891. Report, '91, 2381.

**Physical Characteristics.**

Description of locality, '91, 2381.

**Plans.**

By Lieut. Col. Merrill, for removal of obstructions to such an extent as to enable the creek to be used for rafting purposes, at an estimated cost of \$2,000, '91, 2381.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Merrill, '91, 2381.

**TOLEDO HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 527.)

**Appropriations.****STRAIGHT CHANNEL.**

1884-'87 .....	\$137,500
1888 .....	150,000, '88, 1988.
1890 .....	200,000, '90, 2753.
1892 .....	200,000, '92, 2490.

Total .....	687,500
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**TOLEDO HARBOR, OHIO—Continued.****Appropriations—Continued.****OLD CHANNEL.**

1866-'84 .....	\$704,700
1888 .....	5,000, '88, 1886.
1890 .....	5,000, '90, 2759.

Total ..... 714,700

List of appropriations (straight and old channels), '92, 2490.

**Contracts.**

1889. James Rooney, for dredging, at 20 cents per cubic yard, '89, 2300.

1890. James Rooney, for dredging, at 18½ cents per cubic yard, '90, 2756.

1891. J. Rooney, for dredging, at 19 cents per cubic yard; L. P. & J. A. Smith, for dredging, at 22 cents per cubic yard, '91, 2830; J. Kelly, for construction of 1,800 linear feet of pile protection, at a total of \$20,911, '91, 2834.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 269; '89, 320; '90, 290; '91, 364; '92, 345.

**ENGINEERS IN CHARGE.**

Maj. L. C. Overman, 1883-'92. Reports, '88, 1983; '89, 2298; '90, 2755; '91, 2828.

Lieut. Col. J. A. Smith, 1892-'— Report, '92, 2487.

**ASSISTANTS.**

W. T. Blunt. Report, '90, 2759.

Lieut. W. V. Judson. Report, '92, 2491.

**Operations.**

1887-'88. Old channel: No operations for lack of funds, '88, 1983. Straight channel: 428,913 cubic yards material dredged, '88, 1985.

1888-'89. Old channel: No operations, '89, 2299. Straight channel: 748,940 cubic yards material dredged, '89, 2300.

1889-'90. Old channel: 28,000 cubic yards material dredged, '90, 2756. Straight channel: 659,970 cubic yards material dredged, '90, 2757.

1890-'91. Old channel: 3,494 cubic yards material dredged, '91, 2829. Straight channel: 182,077 cubic yards material dredged, '91, 2830.

1891-'92. Old channel: 20,356 cubic yards material dredged, '92, 2488. Straight channel: 548,599 cubic yards material dredged, '92, 2488.

**Projects.**

The original project of 1866 proposed the deepening, by dredging, of the natural channel in Maumee Bay for a distance of about 1 mile to a width of 200 feet and a depth of 12 feet, '66, iii, 6, 33; iv, 38.

The Board of Engineers in 1869 recommended the adoption of the present location of the channel; estimated cost, \$152,800, '69, 118, 125, 127; '80, 2093.

In 1872 a Board of Engineers submitted three plans, of which the Secretary of War approved that which provided for the widening of the existing channel to 250 feet at the top with a depth of 15 feet, at an estimated cost of \$450,000, '73, 313-324; '77, 953; '80, 2094.

In 1880 the proposed depth was increased to 16 feet, '80, 2097; '87, 2285.

In 1886 there had been obtained a channel 200 feet wide at bottom, and from 15 to 17 feet deep between Toledo and deep water in the lake, under an aggregate of appropriations from 1866 to 1884, inclusive, of \$704,700, '86, 327, 1850; '87, 2283.

In 1887 a Board of Engineers recommended a straight cut from the mouth of the Maumee River to Lake Erie by extending the crib reach at the present natural channel outward into the lake and inward across the bay to the present natural channel of the river, thereby utilizing about 2 miles of the previously improved channel; the channel to have a depth of 17 feet with a bottom width of 200 feet; estimated cost, \$1,875,000, '87, 2286, 2297. Approved by Secretary of War, '87, 2299.

In 1890 it was estimated that \$45,000 would be required to complete the project of 1872 for improvement of the old channel, '90, 2757.

**Surveys.**

Triangulation of Maumee Bay made, 1890, under direction of Maj. Overman, '90, 2759.

**MAPS.**

'89, 2304; '90, 2766; '91, 2831; '92, Atlas, 114.

**TOMS RIVER, N. J.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 119.

ENGINEER IN CHARGE.

Maj. C. W. Raymond, 1890. Report, '91, 1114, 1115.

**Physical Characteristics.**

Description of the locality, '91, 1114.

**Plans.**

By Maj. Raymond, 1891, for excavation of a channel 75 feet wide and 6 feet deep at mean low water from the bridge at the village of Toms River to the 6-foot curve below, a distance of about 3,500 feet; estimated cost, \$10,000, '91, 1115, 1116.

**Surveys.**

Survey ordered by act of September 19, 1890. Made under direction of Maj. Raymond, '91, 1115.

**TOMBIGBEE AND BLACK WARRIOR RIVERS, ALA. AND MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 528.)

**Appropriations.**

1870-'87	.....	\$296,500, '88, 1208.
1888	{ Tombigbee below Vienna.....	6,000, '88, 1208.
	{ Tombigbee from Vienna to Fulton.....	6,500, '88, 1205.
	{ Tombigbee from Fulton to Walkers Bridge.....	4,000, '88, 161.
	{ Black Warrior from Demopolis to Tuscaloosa.....	18,000, '88, 1203.
	{ Black Warrior from Tuscaloosa to Daniels Creek.....	100,000, '88, 1199.
1890	{ Tombigbee from Demopolis to Columbus.....	15,000
	{ Tombigbee from Vienna to Fulton.....	6,000, '90, 1702.
	{ Tombigbee from Fulton to Walkers Bridge.....	4,000, '90, 1701.
	{ Black Warrior from Demopolis to Tuscaloosa.....	100,000, '90, 1700.
	{ Black Warrior from Tuscaloosa to Daniels Creek.....	150,000, '90, 1696.
1892	{ Tombigbee from Vienna to Fulton.....	6,000, '92, 1449.
	{ Tombigbee from Fulton to Walkers Bridge.....	3,000, '92, 1448.
	{ Black Warrior from Tuscaloosa to Daniels Creek.....	200,000, '92, 1444.
	{ Warrior and Tombigbee.....	75,000, '92, 1446.
	{ Tombigbee from its mouth to Demopolis.....	125,000, '92, 1450.
	{ Tombigbee from Demopolis to Columbus.....	35,000, '92, 1451.
Total	.....	1,150,000

**LIST OF APPROPRIATIONS.**

Tombigbee below Vienna, '90, 1703.

Tombigbee from Vienna to Fulton, '89, 1439.

Black Warrior from Tuscaloosa to Daniels Creek, '89, 1198.

Warrior and Tombigbee, '92, 1445.

Warrior River, '92, 1445.

**Commerce.**

Timber shipments on Tombigbee, 1888 to 1890; decrease in freight and transportation expenses, '89, 1438; '90, 1701.

Importance of the improvement to the coal and iron interests on the Warrior River, '92, 1443.

**Contracts.**

1888. Wm. Miller, for construction of lock-tender's house (Black Warrior), at \$1,900, '88, 1199.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 160, 161, 166; '89, 187, 188, 189, 194; '90, 168, 169, 170, 171, 175; '91, 212, 213, 214, 215; '92, 206, 207, 208, 209.

ENGINEER IN CHARGE.

Maj. A. N. Damrell, 1875-'— Reports, '88, 1198, 1200, 1203, 1206, 1226, 1227; '89, 1433, 1435, 1438, 1440; '90, 1696, 1698, 1701, 1702, 1703, 1716; '91, 1776, 1779, 1780, 1781, 1783, 1784; '92, 1440, 1444, 1447, 1448, 1450, 1451.

# **TOMBIGBEE AND BLACK WARRIOR RIVERS, ALA. AND MISS.—Continued.**

## **Operations.**

1887-'88. 1,040 snags removed from the channel, and 432 trees cut from the banks on Tombigbee below Vienna, '88, 1207. 871 snags and stumps removed from the channel and 242 trees from the banks, clearing 25 miles of river and completing the projected improvement between Vienna and Fulton, '88, 1205. No operations on Tombigbee between Walkers Bridge and Fulton, '88, 1226. 3,015 snags removed from the channel, and 775 trees cut from the banks on Black Warrior between Demopolis and Tuscaloosa, '88, 1202. Construction of Lock and Dam No. 1 commenced on Black Warrior between Tuscaloosa and Daniels Creek, '88, 1199.

1888-'89. No operations on Tombigbee from Fulton to and below Vienna, '89, 1439, 1440. Snags and trees removed on Tombigbee between Fulton and Walkers Bridge, '89, 1438. No operations on Black Warrior between Demopolis and Tuscaloosa, '89, 1437. 7,811 cubic yards stone quarried, 2,364 cubic yards stone cut, 1,438 cubic yards stone laid, and 816 cubic yards rock and 1,500 cubic yards earth excavated in lock and dam construction on Black Warrior between Tuscaloosa and Daniels Creek, '89, 1434.

1889-'90. No operations on Tombigbee below Vienna beyond equipment of plant, '90, 1704. No operations on Tombigbee between Vienna and Fulton, '90, 1702. Removal of obstructions continued in Tombigbee between Walkers Bridge and Fulton, '90, 1701. No operations on Black Warrior between Demopolis and Tuscaloosa, '90, 1699. 7,510 cubic yards masonry laid, 4,100 cubic yards stone quarried, 950 cubic yards stone cut, 1,541 cubic yards rock and 3,780 cubic yards earth excavated, and 1,400 cubic yards rock and earth backing placed behind bank wall in lock and dam construction on Black Warrior between Tuscaloosa and Daniels Creek, '90, 1697.

1890-'91. Construction and repair of plant for snagging on the Warrior River, '91, 1778. 454 trees pulled, 2,886 trees cut, and 1,725 logs and stumps removed on Tombigbee between Walkers Bridge and Fulton, '91, 1779. Preparation of plant for work on Tombigbee between Fulton and Vienna, '91, 1781. Snags, logs, and trees removed from the Tombigbee from its mouth up to Demopolis, '91, 1783. 3,446 cubic yards of stone quarried, 1,038 cubic yards cut, and 567 cubic yards laid; 3,132 cubic yards rock excavation in lock pit; 3,700 cubic yards of earth and rock filling behind lock wall in construction of lock and dam in Black Warrior River between Tuscaloosa and Daniels Creek, '91, 1786.

1891-'92. 960 cubic yards rock and 440 square yards of paving used in bank revetment and dam at Lock No. 1; 2,793 cubic yards rock and earth excavated in foundation; 3,475 cubic yards of rock quarried, and 6,121 cubic yards of masonry laid at Lock No. 2; 681 cubic yards stone quarried, at Lock No. 3, Black Warrior from Tuscaloosa to Daniels Creek, '92, 1442. 766 snags and 384 overhanging trees removed on Warrior and Tombigbee rivers, '92, 1446. 3,277 snags removed from channel, and 4,101 trees cleared from the banks on Tombigbee between Fulton and Vienna, '92, 1449. 600 snags, 511 overhanging trees, 2,944 cubic yards of rock, and 3 wrecks removed, and 1,584 linear feet of jetty repaired on Tombigbee from its mouth up to Demopolis, '92, 1450. 2,672 snags and 7,406 overhanging trees removed from Tombigbee between Demopolis and Columbus, '92, 1451.

## **Physical Characteristics.**

Description of Tombigbee and Black Warrior rivers, '88, 1200, 1206; '90, 1716.

## **Plans.**

For improvement from Demopolis to Tuscaloosa on the Black Warrior River by construction of dams and pneumatic gates, snagging, bank revetment, and bar improvement; estimated cost, \$577,000, '91, 1779.

## **Projects.**

The projects of 1871 to 1879, for the improvement of the Tombigbee, proposed the formation of a 4-foot channel from the mouth to Demopolis, and from thence a 3-foot channel to Columbus, by the removal of obstructions, dredging, and construction of wing dams; estimated cost, \$17,000, '79, 832; '80, 1088.

By Maj. Damrell, 1889, for a slack-water navigation from the mouth of the Tombigbee River to Demopolis, to be secured by the construction of three locks and dams, dredging, bank revetment, and snagging; estimated cost, \$508,898, '92, 1450.

By Maj. A. N. Damrell, 1873, for improvement of the Tombigbee River between Fulton and Columbus, a distance of 144 miles, by removal of snags and overhanging trees, securing a good high-water navigation.

In 1879 Maj. Damrell proposed the improvement of the section between Columbus and Vienna, so as to give a low-water channel with a minimum depth of 3 feet and a width of 40 feet by clearing the river bed and banks of obstructions and deepening the bars by dikes and jetties; total required for completion of improvement from the mouth to Fulton, \$205,000, '88, 1204; '89, 1439; '90, 170.

**TOMBIGBEE AND BLACK WARRIOR RIVERS, ALA. AND MISS.—Continued.****Projects—Continued.**

- By Maj. Damrell, 1888, to secure a channel for high-water navigation from Fulton up to Walkers Bridge by the removal of snags and overhanging trees, at an estimated cost of \$11,000, '89, 1438.
- By Maj. Damrell, 1875, for improvement of the Black Warrior River, forming a channel 80 feet wide and 4 feet deep from its junction with the Tombigbee at Demopolis to Tuscaloosa, 140 miles, by removal of obstructions, dredging, blasting, and wing-dam construction; estimated cost, \$151,103, '75, i, 17; '80, 1085.
- By Board of Engineers, 1886, for a slack-water navigation between Tuscaloosa and Daniels Creek, a distance of 15 miles, by the construction of 5 locks with fixed dams; estimated cost, \$741,670, '88, 1198.
- By Maj. Damrell, 1889, for slack-water improvement from Demopolis to Columbus on the Tombigbee by construction of dams with pneumatic gates, bank revetment, snagging, and bar improvement; estimated cost, \$779,408, '90, 1720, 1721; '92, 1451.

**Surveys.**

- Examination for continuous navigation from Vienna, Ala., to Walkers Bridge, Miss. ordered by act of August 5, 1886. Made, 1887, under direction of Maj. Damrell '88, 1226, 1227.
- Survey of Warrior River from Tuscaloosa to Demopolis, and of the Tombigbee, River from its mouth up to Cotton Gin, ordered by act of August 11, 1888., Made, 1889, under direction of Maj. Damrell, '90, 1719.

**TONAWANDA HARBOR AND NIAGARA RIVER, N. Y.—  
IMPROVEMENT OF.**

(Continued from Vol. II, p. 359.)

**Appropriations.**

1881-'82 .....	\$6, 500
1888 .....	100, 000, '89, 2394.
1890 .....	75, 000, '90, 2840.
1892 .....	75, 000, '92, 2533.
Total .....	256, 500

**Commerce.**

Magnitude of lumber interests, '88, 1066.

**Contracts.**

1888. Hingston & Woods, for rock excavation, at \$11.50 per cubic yard, and dredging, at 17 cents per cubic yard, '89, 2394.
1890. Hingston & Woods, for rock removal, at \$4 per cubic yard, '90, 2841.
1891. Hingston & Woods, for rock removal, at \$3.74 per cubic yard, and dredging, at 74 cents per cubic yard, '91, 2890.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 279, 282; '89, 331; '90, 299; '91, 376; '92, 355.

**ENGINEERS IN CHARGE.**

Capt. F. A. Mahan, 1886-'90. Reports, '88, 2056, 2064; '89, 2393.

Maj. A. Stickney, 1890-'92. Reports, '90, 2839; '91, 2888.

Maj. E. H. Ruffner, 1892-'—, Report, '92, 2533.

**Operations.**

1887-'88. No operations, '88, 2056, 2064.

1888-'89. 6,925 cubic yards material dredged, '89, 2394.

1889-'90. 7,950 cubic yards material dredged, '90, 2840.

1890-'91. 6,000 cubic yards rock excavated, '91, 2888.

1891-'92. 9,086 cubic yards rock and 4,324 cubic yards material removed near Strawberry Island; 1,650 cubic yards rock removed by hired labor from Horse-shoe Reef Shoal, '92, 2533.

**Physical Characteristics.**

Description of the locality, '88, 2066.

**Projects.**

- By Maj. McFarland, 1881, for improvement of Tonawanda Creek by excavation of bars at head of Tonawanda Island, mouth of creek opposite Smith & Fassett's Dock, and cutting off point at mouth of Tonawanda Creek; estimated cost, \$5,000, '81, 2429.

# **TONAWANDA HARBOR AND NIAGARA RIVER, N. Y.—** Continued.

## **Projects—Continued.**

By Capt. Mahan, 1887, for improvement of Niagara River between Tonawanda and Black Rock Harbor, giving a 16-foot channel 400 feet wide, by dredging and rock removal at Horseshoe Reef, at head of Strawberry Island, and in the river front at Tonawanda; estimated cost, \$593,538.

In 1891 the estimate for an 18-foot channel 400 feet wide was revised, on account of the excess of rock removal required over that originally estimated for, to \$1,152,987, '91, 2890.

## **Surveys.**

Survey of Tonawanda Harbor and Niagara River, with a view to a 16-foot channel, ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Mahan, '88, 2066.

# **TONGUE RIVER, MONT.—EXAMINATION OF.**

## **Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 277.

ENGINEER IN CHARGE.

Capt. C. F. Powell, 1890. Report, '91, 2237.

## **Physical Characteristics.**

Description of the locality, '91, 2238.

## **Plans.**

In 1890 Capt. Powell did not consider the locality worthy of improvement, '91, 2239.

## **Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Powell, '91, 2238.

# **TOTUSKEY RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 530.)

## **Appropriations.**

1880-'82..... \$10,000

List of appropriations, '88, 825.

## **Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 111; '89, 129; '90, 116.

ENGINEER IN CHARGE.

S. T. Abert, U. S. agent, 1875-'—. Reports, '88, 824; '89, 1011; '90, 1071.

## **Operations.**

1887-'88. Dike at Brookers Bar repaired and mats sunk in front of same, '88, 825.

1888-'90. No operations for lack of funds, '89, 1011; '90, 1071.

## **Physical Characteristics.**

Description of original condition of the river, '88, 824.

## **Projects.**

By S. T. Abert, 1875, for excavation of channel 60 feet wide and 8 feet deep through Brookers Bar, and the construction of 2,400 linear feet of dike parallel with the channel; estimated cost, \$14,960, '75, ii, 160. Total amount appropriated from 1880 to 1882, inclusive, \$10,000; amount estimated to complete project, \$12,000, '87, 939.

# **TOWN RIVER, MASS.—SURVEY OF.**

## **Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 47.

ENGINEER IN CHARGE.

Lieut. Col. S. M. Mansfield, 1890. Report, '91, 680.

ASSISTANT.

S. Haagensen. Report, '91, 680.

**TOWN RIVER, MASS.—Continued.****Physical Characteristics.**

Description of the locality, '91, 681.

**Plans.**

By Lieut. Col. Mansfield, 1890, for excavation of a channel for a distance of 4,500 feet at the head of navigation, 100 feet wide and 4 feet deep at mean low water; estimated cost, \$20,000, '91, 680.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Mansfield, '91, 680.

**TRADEWATER RIVER, KY.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 531.)

**Appropriations.**

1881-'87 .....	\$10,500
1888 .....	6,000, '88, 1748.

Total .....	16,500
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 221; '89, 262; '90, 236; '91, 304; '92, 290.

**ENGINEERS IN CHARGE.**

Maj. A. Stickney, 1887-'89. Report, '88, 1747.

Maj. D. W. Lockwood, 1889-'—. Reports, '89, 1964; '90, 2253; '91, 2438; '92, 2073.

**Operations.**

1887-'88. Removal of obstructions over 19 miles of river, '88, 1747.

1888-'89. No operations, '89, 1964.

1889-'90. 415 snags removed from the channel, and 12,000 trees and logs cleared from the banks, '90, 2254.

1890-'91. 669 snags and 511 logs removed from the channel, and 2,551 stumps and 279 trees cleared from the banks, '91, 2438.

1891-'92. No operations, '92, 2074.

**Projects.**

By Capt. Cuyler, 1880, for improvement of descending navigation on the Tradewater River by removal of snags, logs and similar obstructions, and excavation of a channel through the natural rock barrier at the mouth of the river, so as to give a channel 40 feet wide with a minimum depth of 2½ feet during eight months of the year, for a distance of 41 miles; estimated cost, \$10,000, '81, 1994; '88, 1747.

**TRENT RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 533.)

**Appropriations.**

1879-'87 .....	\$45,500
1888 .....	5,000, '88, 864.
1890 .....	5,000, '90, 1120.
1892 .....	5,000, '92, 1127.

Total .....	60,500
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List of appropriations, '92, 1128.

**Commerce.**

Decrease in transportation and insurance rates consequent upon improvement, '89, 1055, 1141.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 118; '89, 137, 149; '90, 124; '91, 158; '92, 159.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 862; '89, 1052, 1140; '90, 1119; '91, 1355.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1125.

**TRENT RIVER, N. C.—Continued.****Engineers—Continued.****ASSISTANTS.**

R. Ransom. Reports, '88, 864; '89, 1054; '90, 1121; '91, 1357.

E. D. Thompson. Report, '89, 1054.

**Operations.**

1887-'88. 270 logs, trees, and snags removed from river channel, and 107 trees trimmed on the banks, '88, 864.

1888-'89. 1,220 trees, snags, and stumps, 49 cords small snags, and 14,677 cubic yards of other material removed from the channel, '89, 1053.

1889-'90. No operations, '90, 1120.

1890-'91. 1,273 snags and stumps removed from the channel, and 796 trees and 187 cords of brush cleared from the banks, '91, 1356.

1891-'92. No operations, '92, 1127.

**Physical Characteristics.**

Description of the Trent River, '89, 1140.

**Projects.**

By Capt. Phillips, 1879, for improvement of the river below Trenton, to secure a depth of 3 feet at the extreme low summer stage of the river, by removal of snags, fallen and leaning trees, by dredging, and by dike and dam construction; estimated cost, \$22,000, '79, 711, 714. Estimate increased in 1885 and 1887 to \$59,000, '87, 1017.

By Capt. Bixby, 1889, for improvement of the river from Trenton to Upper Quaker Bridge by clearing out natural obstructions from Trenton upward; for small steamboats over the first 30 miles, and for pole boats over the remaining 13 miles up to Upper Quaker Bridge; estimated cost, \$13,000. This, together with the amount required for completion of the prior project, made a total for completion in 1890, of \$16,500, '90, 1120; '92, 1126.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1140.

**MAPS.**

'89, 1054; '92, Atlas, 24, 25.

**TRINITY RIVER, TEX.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 534.)

**Appropriations.**

1852-'82 .....	\$37,500
1888 .....	12,500, '88, 1284.
1890 .....	10,000, '90, 1804.
1892 .....	10,000, '92, 1542.

Total ..... 70,000

**Contracts.**

1889. B. F. Hutches, for jetty construction, at \$2.73 per linear foot, '90, 1805.

1891. J. J. Atkinson, for timber jetty construction, at \$2.90 per linear foot, '91, 1921.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 174; '89, 204; '90, 184; '91, 233, 235, 1936; '92, 226.

**ENGINEERS IN CHARGE.**

Maj. O. H. Ernst, 1886-'90. Reports, '88, 1285; '89, 1557.

Maj. C. J. Allen, 1890-'— Reports, '90, 1802; '91, 1918, 1936; '92, 1540.

**ASSISTANTS.**

E. M. Hartrick. Report, '90, 1805.

G. Bagnall. Reports, '91, 1921; '92, 1542.

**Operations.**

1887-'89. No operations, '88, 1287; '89, 1559.

1889-'90. 3,269 linear feet of jetty built under contract, '90, 1803.

1890-'91. 1,360 linear feet of revetment built, and repairs made to existing works, '91, 1919.

1891-'92. Repairs to existing works completed, '92, 1542.

**Physical Characteristics.**

Description of the locality, '89, 1557; '90, 1802.

**Plans.**

After examination in 1891 Maj. Allen did not consider the river worthy of further improvement, '91, 1938.

**TRINITY RIVER, TEX.—Continued.****Projects.**

By Capt. Howell, 1871 and 1873, for improvement of Trinity River, securing a 5-foot channel from the mouth up to Liberty, by construction of pile breakwater at the mouth, removal of snags, and dredging; estimated cost, \$46,000, '71, 537; '73, 685; '80, 1238. Increased in 1887 to \$59,500, '87, 1422.

In 1889 Maj. Ernst proposed the construction of two parallel sheet-pile jetties, each 7,600 feet in length and 275 feet apart, to concentrate the river flow across the bar; also low, submerged dams across the two principal passes, to prevent their enlargement; estimated cost, \$55,000, making the original estimated cost of the project, as revised, \$89,500, '89, 1558; '92, 1541.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Allen, '91, 1936.

**TROUTBURG HARBOR, N. Y.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 337.

ENGINEER IN CHARGE.

Capt. C. F. Palfrey, 1888. Report, '89, 2426.

**Plans.**

In 1889 Capt. Palfrey did not consider the locality worthy of improvement as a harbor of refuge, '89, 2427.

**Surveys.**

Examination for harbor of refuge ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Palfrey, '89, 2426.

MAPS.

'89, 2426.

**TUALATIN RIVER, OREG.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 357.

ENGINEER IN CHARGE.

Capt. W. Young, 1888. Report, '89, 2525.

**Physical Characteristics.**

Description of the river, '89, 2525.

**Plans.**

In 1888 Capt. Young considered the cost of improving the river greatly in excess of the benefits to be conferred upon its commerce, '89, 2526.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Capt. Young, '89, 2525.

**TUCKAHOE RIVER, MD.—EXAMINATION OF.**

(Continued from Vol. II, p. 535.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 112.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1888. Report, '89, 921.

ASSISTANT.

A. Stierle. Report, '89, 922.

**Physical Characteristics.**

Description of the locality, '89, 922.



**TUCKAHOE RIVER, MD.—Continued.****Plans.**

By W. F. Smith, 1889, for excavation of a channel 10 feet deep at low water and 50 feet wide from Waymans Wharf to the bridge at Hillsborough; estimated cost \$42,000, '89, 923.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of W. F. Smith.

**TURNERS CREEK, MD.—SURVEY OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 132.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1890. Report, '91, 1211, 1213.

ASSISTANT.

A. Stierle. Report, '91, 1212, 1214.

**Physical Characteristics.**

Description of the locality, '91, 1212.

**Plans.**

By W. F. Smith, 1891, for removal, by dredging, of a point projecting into the mouth of the creek and the construction of a spur dike 400 feet in length near the entrance; estimated cost, \$4,060, '91, 1213.

**TUG FORK, KY. AND W. VA.—(See BIG SANDY RIVER, KY. AND W. VA.)****TWO RIVERS HARBOR, WIS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 535.)

**Appropriations.**

1871-'84 .....	\$198,000
1888 .....	2,500, '88, 1851.
1890 .....	3,000, '90, 2340.
1892 .....	3,000, '92, 2190.

Total ..... 206,500

List of appropriations, '92, 2190.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 240; '89, 279; '90, 252; '91, 322; '92, 308.

ENGINEERS IN CHARGE.

Maj. C. E. L. B. Davis, 1888-'92. Reports, '88, 1850; '89, 2058; '90, 2342; '91, 2543.

Maj. J. F. Gregory, 1892-'—. Report, '92, 2189.

**Operations.**

1887-'88. No operations, '88, 1850.

1888-'89. 12,772 cubic yards material dredged by hired labor, '89, 2058.

1889-'90. 75 cords stone used in riprapping, by hired labor, the north and south piers, '90, 2342.

1890-'91. Pile bulkheads built by hired labor for protection of north and south piers, and repairs made to north and south piers, '91, 2544.

1891-'92. No operations, '92, 2189.

**Projects.**

By Maj. Houston, 1870, for improvement of the harbor by construction of 2 parallel piers 260 feet apart and extending to the 18-foot curve in the lake, and dredging between them to a depth of 12 feet; length of piers, 1,810 and 1,710 feet, respectively; estimated cost, \$265,588.80, '71, 111; '74, i, 144; '75, i, 200; '86, 1665, 1666.

In 1877 the project was modified to provide for a sand-tight revetment to the pile piers, '77, 860; '78, 1156; '79, 1512, 1514.

Total amount appropriated from 1871 to 1886, inclusive, \$198,000; estimated cost of completion of project, \$67,588, '86, 298.

**UMPQUA RIVER, OREG.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 536.)

**Appropriations.**

1871-'87 .....	\$22, 501. 47
1888 .....	2, 000. 00, '88, 2145.
1890 .....	9, 000. 00, '90, 2966.
Total .....	33, 501. 47

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 298; '89, 355, 357, 358; '90, 319, 324; '91, 402; '92, 377.

**ENGINEERS IN CHARGE.**

Capt. W. Young, 1887-'90. Reports, '88, 2144; '89, 2511, 2572.

Capt. T. W. Symons, 1890—'. Reports, '90, 2965, 3005; '91, 3169; '92, 2679.

**ASSISTANT.**

R. Warrack. Report, '90, 3008.

**Operations.**

1887-'89. No operations for lack of funds, '88, 2144; '89, 2512.

1889-'90. 700 tons of rock drilled, blasted, and removed from the channel, '90, 2966.

1890-'91. No operations, '91, 3170.

1891-'92. 955 tons of rock blasted and removed, '92, 2679.

**Plans.**

In 1888 Capt. Young did not consider the river between Scottsburg and Harts Rapids worthy of improvement, '89, 2527.

By Capt. Symons, 1890, for improvement between Scottsburg and the mouth by removal of rock boulders and ledges, giving a channel way 50 feet wide and 4 feet deep at low water; estimated cost, \$9,000, '90, 3007.

**Projects.**

By Maj. R. S. Williamson, for improvement of Umpqua River by removal of obstructions to a high-water navigation from Scottsburg to Roseburg; estimated cost, \$22,549, '71, 912; '86, 2005.

In 1886 the project proposed the expenditure of the balance of the appropriation of 1871, at and below Scottsburg, in the excavation of a channel 50 feet wide and 3 feet deep at low water through five rock ledges; estimated cost, \$4,056, '86, 2005; '87, 326; '88, 2144.

By Capt. Symons, 1889, for the formation of a channel 50 feet wide and 4 feet deep at low water from Scottsburg to the mouth by removal of ledge rock and boulders, at an estimated cost of \$9,000, '90, 3007; '91, 3169.

**Surveys.**

Examination between Scottsburg and Harts Rapids ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Young, '89, 2872.

Survey of the river between Scottsburg and the mouth ordered by act of August 11, 1888. Made, 1890, under direction of Capt. Symons, '90, 3007.

**UNION RIVER AND BAY, ME.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 31; '90, 26.

**ENGINEER IN CHARGE.**

Lieut. Col. J. A. Smith, 1890. Report, '90, 458.

**Physical Characteristics.**

Description of the locality, '90, 458.

**Plans.**

By Lieut. Col. Smith, 1890, for excavation of a channel with a mean low water depth of 6 feet and a width of from 100 to 150 feet from Lords Wharf to Ellsworth; also for contraction of the river at its mouth by construction of a rubble-stone jetty and training wall with a combined length of 6,700 feet, running from the western shore across Hortons Rocks, and thence parallel to and about 800 feet from the eastern shore; estimated cost, \$225,000, '90, 462, 463.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1890, under direction of Lieut. Col. Smith, '90, 461.

**UPPER COLUMBIA RIVER.**—(See COLUMBIA RIVER, UPPER.)

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**UPPER MISSISSIPPI RIVER.**—REMOVAL OF OBSTRUCTIONS FROM.

(See MISSISSIPPI RIVER, UPPER.)

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**UPPER SAINT JOHNS RIVER, FLA.**—(See SAINT JOHNS RIVER, UPPER.)

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**UPPER WILLAMETTE RIVER, OREG.**—(See WILLAMETTE RIVER, UPPER.)

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**UPPER MACHODOC CREEK, VA.**—EXAMINATION OF.

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 146, 1286.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1890. Report, '91, 1287.

**Physical Characteristics.**

Description of the locality, '91, 1287.

**Plans.**

In 1890 Lieut. Col. Hains did not consider the creek worthy of improvement, '91, 1287.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Lieut. Col. Hains, '91, 1287.

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**URBANA CREEK, VA.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 537.)

**Appropriations.**

1879-'82 .....	\$15,500
1890 .....	3,000, '90, 1071.
1892 .....	3,000, '92, 1056

Total ..... 21,500

List of appropriations, '88, 826.

**Contracts.**

1889. American Dredging Company, for dredging, at 19 cents per cubic yard, '90, 1070.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 112; '89, 128; '90, 115; '91, 142; '92, 143.

ENGINEERS IN CHARGE.

S. T. Abert, U. S. agent, 1875-'91. Reports, '88, 825; '89, 1009; '90, 1070.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1268.

Maj. C. E. L. B. Davis, 1892-'— . Report, '92, 1054.

**Operations.**

1887-'89. No operations for lack of funds, '88, 826; '89, 1010.

1889-'90. 8,069 cubic yards material dredged under contract; 240 linear feet sand dike built, and 212 linear feet of brush wattling repaired by hired labor, '90, 1070.

1890-'91. No operations, '91, 1268.

1891-'92. 5,674 cubic yards material dredged, '92, 1055.

**URBANA CREEK, VA.—Continued.****Physical Characteristics.**

Description of the creek, '88, 825.

**Projects.**

The project for this improvement proposed a cut through the bar at the mouth of the creek, with a width of 150 feet and a depth of 10 feet. This was extended in 1883 (see Report of 1884) to include the removal of the bar in the harbor. The sand spit at the mouth was to be reinforced against the tides by a wattled dike. After an examination, made in 1888, a system of dikes was adopted to prevent the dredged channel from filling with sand, and a revised estimate made the cost \$19,080, '89, 1009; '92, 1056.

**Surveys.**

MAPS.

'89, 1010; '90, 1070.

**VANDALIA, LA.—(See MISSISSIPPI RIVER BETWEEN MOUTH OF OHIO AND HEAD OF THE PASSES.)****VERMILLION, S. DAK.—(See MISSOURI RIVER BETWEEN SIOUX CITY AND FORT BENTON.)****VERMILLION HARBOR, OHIO.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 538.)

**Appropriations.**

1836-'87 .....	\$123, 701. 28
1888 .....	1, 000. 00, '88, 1999.
1890 .....	2, 000. 00, '90, 2775.
1892 .....	2, 000. 00, '92, 2501.

Total ..... 128, 701. 28

List of appropriations, '92, 2500.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 272; '89, 324; '90, 293; '91, 368; '92, 348.

ENGINEERS IN CHARGE.

Maj. L. C. Overman, 1883-'92. Reports, '88, 1998; '89, 2316; '90, 2774; '91, 2847.

Lieut. Col. J. A. Smith, 1892-'—. Report, '92, 2500.

**Operations.**

1887-'89. No operations, '88, 1998; '89, 2316.

1889-'90. Repairs to piers by hired labor, '90, 2774.

1890-'92. No operations, '91, 2848; '92, 2500.

**Projects.**

The earliest project, 1836, proposed the extension of two parallel piers from each side of the river's mouth to the 10-foot curve in the lake. In 1838 the project was amended to provide for dredging between the piers. The project was subsequently amended to provide for an increase of depth to 12 feet, involving rock removal from the channel between the piers, '66, i, 27; '72, 228; '73, 332; '74, i, 219; '77, 960; '80, 2122.

In 1880 the project was expanded to provide for an increase of channel depth to 14 feet from deep water in the lake to the city wharves, '80, 2126; '86, 1860.

Total amount appropriated from 1836 to 1886, inclusive, \$123,701.28; estimated cost of completion of existing project, \$11,000, '86, 1860, 1861; '87, 2311.

In 1892 Lieut. Col. Smith did not consider the commerce of the harbor sufficiently extensive to justify any further expenditure other than such as would be required for the preservation of existing works, '92, 2500.

**Surveys.**

MAPS.

'91, 2848.

8648—30

**VICKSBURG, MISS.**—(See MISSISSIPPI RIVER BETWEEN MOUTH OF THE OHIO AND HEAD OF THE PASSES.)

**VINEYARD HAVEN HARBOR, MASS.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 540.)

**Appropriations.**

1888.....	\$25,000, '88, 34.
1890.....	10,000, '90, 557.
1892.....	7,500, '92, 606.

Total ..... 42,500

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '88, 34; '89, 45; '90, 39; '91, 50; '92, 54.

**ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1882-'92. Reports, '89, 611; '90, 556; '91, 700.

Capt. W. H. Bixby, 1892-'— Report, '92, 604.

**Operations.**

1887-'89. No operations, '88, 34; '89, 611.

1889-'90. Temporary wharf and 3 riprap jetties built, '90, 557.

1890-'91. 1,064 tons stone used in jetty construction, '91, 700.

1891-'92. 3,386 tons stone used in jetty construction, '92, 605.

**Physical Characteristics.**

Description of the locality, '89, 6M.

**Projects.**

By Lieut. Col. Warren, 1882, for protection of 5,000 linear feet of bluff by the construction of riprap jetties and shore protection, requiring the deposit of 40,000 tons of riprap; estimated cost, \$60,000, '82, 594; '90, 556.

**Surveys.**

Survey of "East" and "West Chops." Made, 1889, under direction of Maj. Livermore, '89, 611.

**VOLUSIA BAR, FLA.**—IMPROVEMENT OF.

(Continued from Vol. II, p. 540.)

**Appropriations.**

1880-'87.....	\$25,000
1888.....	500, '88, 1090.
1890.....	500, '90, 1565.
1892.....	1,000, '92, 1370.

Total ..... 27,000

List of appropriations, '92, 1369.

**Engineers.**

**CHIEF OF ENGINEERS.**

Reports, '88, 145; '89, 166; '90, 149; '91, 187; '92, 184.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1886-'92. Reports, '88, 1088; '89, 1308; '90, 1564; '91, 1627.

Maj. J. C. Mallery, 1892-'—. Report, '92, 1369.

**Operations.**

1887-'88. No operations, '88, 1089.

1888-'89. Repairs to pile-fender system, '89, 1309.

1889-'90. 100 cubic yards stone placed in west jetty, '90, 1565.

1890-'91. 175 tons of rock used in repair of jetty, '91, 1628.

1891-'92. Repair of jetty completed, '92, 1369.

**Projects.**

By Col. Gillmore, for narrowing the existing channel by two converging brush and stone jetties, starting from the shore and extending to the 6-foot curve in the lake, and with such width between the ends as will maintain a channel depth of 6 feet at low water, the channel to be further defined and guarded by rows of fender piles, and deepened by dredging, if necessary; estimated cost, \$15,000, '80, 972. Revised estimate, \$25,000, '86, 1135; '87, 1217.

**WABASH RIVER, IND.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 541.)

**Appropriations.**

1828-'87.....	\$559,500
1888 { Below Vincennes..	60,000, '88, 1739.
{ Above Vincennes..	5,000, '88, 1744.
1890 { Below Vincennes..	60,000, '90, 2229.
{ Above Vincennes..	5,500, '90, 2232.
1892 { Below Vincennes..	60,000, '92, 2032.
{ Above Vincennes..	5,000, '92, 2035.
Total .....	755,000

**Contracts.**

1888. M. Cox, for furnishing dredge hull, at \$995; C. E. Rees, for furnishing lock stone, at \$36,338.56, '88, 1740.  
 1889. Salem Stone and Lime Company, for furnishing lock stone, at \$22,400, '89, 1930.  
 1891. Romona Oolitic Stone Company, for furnishing stone for construction of dam abutment, at a total of \$6,541.80, '91, 2403. Dark Hollow Quarry Company, for furnishing lock stone, at a total of \$16,631.75, '91, 2404.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 220; '89, 256, 257; '90, 231; '91, 297, 298, 241; '92, 284.

**ENGINEERS IN CHARGE.**

Maj. A. Stickney, 1886-'90. Reports, '88, 1738; '89, 1928.  
 Capt. E. Maguire, 1890-'91. Reports, '90, 2229; '91, 2411.  
 Maj. G. J. Lydecker, 1891-'—. Reports, '91, 2402; '92, 2031.

**ASSISTANT.**

O. L. Petitdidier. Reports, '88, 1740, 1744; '89, 1931, 1935; '90, 2229, 2233; '91, 2402, 2406; '92, 2032, 2036.

**Operations.**

- 1887-'88. Below Vincennes: 2,583 cubic yards earth placed in levee across Grayville Bend Cut-off, extending the same 250 feet; excavation of old lock walls completed, and foundation for new lock and dam at Grand Rapids begun. Above Vincennes: No operations for lack of funds, '88, 1741-1743.  
 1888-'89. Below Vincennes: 1,743 cubic yards masonry laid, partially completing land and river walls and lower miter sill of Grand Rapids Lock and Dam; 990 linear feet of stone dike built in continuation of eastern end of present levee; 151 snags removed between Mount Carmel and mouth of river. Above Vincennes: 448 snags removed from the channel between Wolfe Cut-off and Terre Haute, '89, 1931-1936.  
 1889-'90. Below Vincennes: 3,078 cubic yards masonry laid, completing lower and upper miter sills and left wall, river and land walls. Above Vincennes: No operations for lack of funds, '90, 2230-2235.  
 1890-'91. Below Vincennes: Three timber and stone spur dikes completed, and levee at Grayville Bend extended 1,750 feet, '91, 2404. Construction of lock and dam at Grand Rapids in progress, '91, 2405. Snag removal between Mount Carmel and Coffee Chute, '91, 2406. Above Vincennes: No operations, '91, 2408.  
 1891-'92. Below Vincennes: West abutment of dam completed; lock construction in progress; crib dike at Little Chain repaired and filled with stone; 430 snags removed, '92, 2031. Above Vincennes: No operations, '92, 2036.

**Plans.**

After examination in 1890 Capt. Maguire did not consider the portion of the river between Terre Haute and La Fayette worthy of improvement, '91, 2411.

**Projects.**

The projects of 1872 proposed the improvement of the river from its mouth to Vincennes by construction of lock and dam at Grand Rapids; the construction of wing dams at various points, and removal of rocky ledges, snags, logs, and similar obstacles, so as to give a navigable channel of 3½ feet at extreme low water; also for improvement of river from Vincennes to Terre Haute by closing cut-offs, concentration of current by training walls and wing dams and removal of snags and rock obstructions, '72, 463, 472; '73, 59, 511; '74, 1, 66, 486; '80, 1841.

From 1871 to 1886, inclusive, \$573,000 was appropriated.

In 1887 it was estimated that \$250,600 would be required to complete the project for that part of the river below Vincennes, and \$20,000 for the river above Vincennes, '87, 1864, 1869.

**WABASH RIVER, IND.—Continued.****Projects—Continued.**

In 1888 the estimate for completion of improvement below Vincennes was increased to \$276,600, '88, 1739.

In 1889 the estimate for completion of the improvement above Vincennes was increased to \$20,000, '89, 1935.

**Surveys.**

Examination between Terre Haute and La Fayette ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Maguire, '91, 2411.

**WACCAMAW RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 542.)

**Appropriations.**

1880-'87 .....	\$50,400
1888 .....	15,000, '88, 914.
1890 .....	12,500, '90, 1231.
1892 .....	10,000, '92, 1197.

Total ..... 87,900

List of appropriations, '89, 1199.

**Commerce.**

Increase in, due to improvement, '88, 916.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 126; '89, 157; '90, 140; '91, 170; '92, 170.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'89. Report, '88, 912.

Capt. F. V. Abbot, 1889-'—. Reports, '89, 1198; '90, 1229; '91, 1442; '92, 1195.

**ASSISTANT.**

R. Whitford. Reports, '88, 914; '89, 1200; '90, 1231; '91, 1443; '92, 1197.

**Operations.**

1887-'88. 462 trees, logs, and snags removed from the river; 710 trees removed from banks; repairs to jetties at Big Needles Eye Shoal and Oat Bed Shoal, '88, 913.

1888-'89. 2,410 trees and snags and 6 cords of small snags removed from the channel; 5,374 trees cut and trimmed, and 234 cords of brush removed from the banks, '89, 1200.

1889-'90. 991 trees, stumps, and snags and 6 cords small snags removed from the channel, and 1,905 trees cut and trimmed upon the banks, '90, 1231.

1890-'91. 2,739 snags and logs and 10 cords of small snags removed from the channel, and 5,900 trees and 106 cords of brush cleared from the banks, '91, 1443.

1891-'92. 576 snags removed from the channel, and 1,074 trees and 7 cords of brush cleared from the banks, '92, 1197.

**Projects.**

By Capt. Phillips, 1880, for improvement of Waccamaw River by formation of a channel 12 feet deep at all stages of water, with 80 feet bottom width, from the mouth of the river 66 miles upward to Conwayborough; also a channel 178 miles farther to Lake Waccamaw; estimated cost, \$29,370, '80, 848. Estimate revised in 1885 and 1886 to \$138,400, '85, 1105; '86, 1022; '92, 1196.

**Surveys.****MAPS.**

'89, 1200.

**WAPPINGERS CREEK, N. Y.—IMPROVEMENT OF.****Appropriations.**

1890 .....	\$13,000, '91, 886.
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 83; '90, 74; '91, 84; '92, 88.

**ENGINEER IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1888-'—. Reports, '90, 758; '91, 885; '92, 778.

**ASSISTANT.**

C. G. Weir. Report, '90, 760.

**WAPPINGERS CREEK, N. Y.—Continued.****Operations.**

1891-'92. 600 linear feet of bulkhead built, and 50,000 cubic yards of material dredged and placed behind the same, '92, 777.

**Physical Characteristics.**

Description of the locality, '90, 758.

**Projects.**

By Lieut. Col. Gillespie, 1889, for excavation of a navigable channel 80 feet wide and 8 feet deep at mean low water from Wappingers Falls to the mouth of the creek; estimated cost, \$13,000, '90, 759.

Project completed in 1892, and no further appropriation recommended, '92, 777.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Gillespie, '90, 759.

**WAPPOO CUT, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 545.)

**Appropriations.**

1881-'87 .....	\$28,000
1888 .....	5,000, '88, 982.
1890 .....	10,000, '90, 1228.
1892 .....	10,000, '92, 1232.

Total ..... 53,000

List of appropriations, '88, 982.

**Commerce.**

Commercial importance of the cut, '88, 981.

**Contracts.**

1888. A. M. Bangs, for revetting banks, at a total of \$3,274, '89, 1198.

1890. T. Young, for dredging, at 24 cents per cubic yard, '91, 1479.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 135; '89, 156; '90, 140; '91, 176; '92, 174.

**ENGINEER IN CHARGE.**

Capt. F. V. Abbot, 1888-'—. Reports, '8', 980; '89, 1196; '90, 1227; '91, 1477; '92, 1231.

**ASSISTANTS.**

R. Whitford. Report, '89, 1200.

J. P. Allen. Reports, '90, 1228; '91, 1479.

**Operations.**

1887-'88. 20,195 cubic yards of material dredged from Elliot and Marsh cuts; '88, 981.

1888-'89. 1,300 linear feet of bank of Elliots Cut graded and covered with stone, '89, 1197.

1889-'90. No operations, '90, 1227.

1890-'91. 33,514 cubic yards of material dredged, 21 trees and stumps and 8 cords of brush removed from bank at Elliots Cut, '91, 1479.

1891-'92. No operations, '92, 1231.

**Projects.**

By Col. Gillmore, 1880, for improvement of Wappoo Cut by excavation of a channel 90 feet wide and 6 feet deep at low water from the deep water of the Ashley to that of the Stono River; also for 1,600 linear feet of jetty construction at either end of the proposed channel and 700 linear feet of bulkhead to close tidal branch; estimated cost, \$34,000, '81, 1073. Increased \$3,000 in 1885, '85, 1187; '87, 1138, 1139.

Project revised in 1888 as follows: To secure a channel width of 60 feet between low-water lines; building two training walls at the Stono River entrance; revetting with stone both banks of Elliots Cut; making a cut through the marsh just east of Elliots Cut, and constructing two closing dams; building a slight dam near the western end of Marsh Cut; making a cut 200 feet wide and 7 feet deep at mean low water across Ashley River Bar; total estimated cost, including work already done, \$88,000, '89, 1196; '91, 1477, 1478.

**Surveys.****MAPS.**

'89, 1200; '91, 1479.



**WAREHAM HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 545.)

**Appropriations.**

1872-'87 .....	\$80,000
1888 .....	4,000, '88, 491.
1890 .....	5,000, '90, 560.
1892 .....	7,236, '92, 608.

Total .....	96,236
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**Contracts.**

1891. J. H. Fenner, for dredging, at 20 cents per cubic yard, '91, 703.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 35; '89, 46; '90, 40; '91, 50; '92, 54.

**ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1887-'92. Reports, '88, 489; '89, 612; '90, 558; '91, 701.

Capt. W. H. Bixby, 1892-'— Report, '92, 607.

**Operations.**

1887-'88. 10,680 cubic yards material dredged, '88, 490.

1888-'89. No operations, '89, 613.

1889-'90. Southern half of "Reach No. 8" dredged to a width of 175 feet and depth of 10 feet; "Middle Ground" removed, '90, 559.

1890-'91. No operations, '91, 702.

1891-'92. 7,292 cubic yards material dredged, '92, 608.

**Physical Characteristics.**

Description of locality, '90, 558.

**Projects.**

The project of 1871 proposed the formation, by dredging, of a channel 9 feet deep at low water across Quahaug Bar, the widening of the channel below the Franconia Iron Works, and the removal of the ledge from the Weweeanlight River at its junction with Wareham River; estimated cost, \$45,000, '72, 953.

By Lieut. Col. Warren, 1880, for improvement of the harbor by widening the channel through the "upper bar" to 350 feet, with a depth of 10 feet, widening and straightening the channel thence to Barneys Point to 250 feet width and 10 feet depth; also widening channel at Quahaug Bar, and construction of brush and stone barriers for the preservation of Long Beach; estimated cost, \$44,050, '81, 553, 554; '87, 541. Increased, 1887, by \$12,186, '87, 542; '92, 607.

**WARE RIVER, VA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 135.

**ENGINEER IN CHARGE.**

Mr. S. T. Abert, U. S. agent, 1888. Report, '89, 1034.

**Physical Characteristics.**

Description of the locality, '89, 1034.

**Plans.**

In 1888 Col. Craighill did not consider the locality worthy of improvement, '89, 1034.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of S. T. Abert, '89, 1034.

**WARREN RIVER, R. I.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 546.)

**Appropriations.**

1886-'87 .....	\$5,000
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**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 38; '89, 48; '90, 43.

**ENGINEER IN CHARGE.**

Maj. W. R. Livermore, 1887-'91. Reports, '88, 494; '89, 620; '90, 565.

**WARREN RIVER, R. I.—Continued.****Operations.**

1887-'88. 811 tons of bowlders, ledge rock, and gravel removed, completing projected improvement, '88, 495.

**Projects.**

By Lieut. Col. Elliot, 1885, for improvement of Warren River by removal of Bushworth Rock and bowlders in narrow portion of the channel below Little Island; estimated cost, \$5,000, '85, 628; '87, 547.

**WARRIOR RIVER, ALA.—(See TOMBIGEE AND BLACK WARRIOR RIVERS.)****WARWICK RIVER, MD.—SURVEY OF.****Appropriations.**

1892..... \$6,000

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 112; '91, 132.

**ENGINEER IN CHARGE.**

W. F. Smith, U. S. agent, 1888-'92. Reports, '89, 112; '91, 1218.

**ASSISTANT.**

A. Stierle. Reports, '89, 919; '91, 1218.

**Physical Characteristics.**

Description of the locality, '89, 919; '91, 1219.

**Plans.**

By W. F. Smith, 1889, for a 12-foot low-water channel 100 feet wide across the bar at the river's mouth; estimated cost, \$37,000, '89, 920.

By W. F. Smith, 1891, for a 10-foot low-water channel 100 feet wide from the Choptank River to the wharves; estimated cost, \$18,600, '91, 1220.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of W. F. Smith, '89, 919.

Survey made, 1891, under direction of W. F. Smith, '91, 1219.

**WASHINGTON AQUEDUCT, D. C.**

(Continued from Vol. II, p. 547.)

**Appropriations.**

1850-'87 .....	\$3,934,435	} '91, 3897.
1888 .....	20,000	
1889 .....	20,000	
1890 .....	25,000	
1891 .....	20,000	

Total ..... 4,019,435

NOTE.—Since 1878 one-half the amounts appropriated have been contributed by the United States, and the other half by the District of Columbia. '91, 3897.

List of appropriations, '88, 2754.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 310; '89, 378; '90, 345; '91, 436.

**ENGINEERS IN CHARGE.**

Maj. G. J. Lydecker, 1883-'89. Report, '88, 2749.

Col. J. M. Wilson, 1889-'90. Report, '89, 2809.

Lieut. Col. G. H. Elliot, 1890-'— Reports, '90, 3501; '91, 3875.

**Operations.**

1878-'88. General repairs necessary for maintenance of aqueduct and works relating thereto, '88, 2749.

1888-'89. General repairs necessary for maintenance of aqueduct and works relating thereto, '89, 2809.

**WASHINGTON AQUEDUCT, D. C.—Continued.****Operations—Continued.**

1889-'90. General repairs necessary for maintenance of aqueduct and works relating thereto, '90, 3502.

1890-'91. General repairs necessary for maintenance of aqueduct and works relating thereto, '91, 3877.

**Physical Characteristics.**

Outflow of water from the reservoir measured at specific intervals, '88, 2751; '89, 2813; '90, 3515; '91, 3893.

**Projects.**

By Lieut. Col. Elliot, 1890, for improvement of the receiving reservoir, including the purchase or condemnation of the necessary land; for improvement of the distributing reservoir by lowering the height of the cross dam; protecting the inlet to the aqueduct at Great Falls; for cleaning out the distributing reservoir, and for maintenance and repairs; estimated cost, \$346,950, '90, 3509.

**Surveys.****MAPS.**

'90, 3505; '91, 3897.

**WASHINGTON HARBOR, PAMLICO RIVER, N. C.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 170.

**ENGINEER IN CHARGE.**

Capt. W. H. Bixby, 1890. Report, '91, 1429, 1433.

**ASSISTANT.**

Lieut. M. M. Patrick. Report, '91, 1431.

**Physical Characteristics.**

Description of the locality, '91, 1429.

**Plans.**

By Capt. Bixby, 1890, for excavation of a channel 9 feet deep and 200 feet wide into Washington Harbor, at an estimated cost of \$45,000, '91, 1434.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Bixby, '91, 1429.

**WASHINGTON, D. C.—INCREASING WATER SUPPLY OF.**

(Continued from Vol. II, p. 548.)

**Appropriations.**

1882-'87 .....	\$1,665,279.30
1888 .....	355,000.00, '92, 3382.

Total ..... 2,020,279.30

List of appropriations, '90, 3532.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 310; '89, 378; '90, 348; '91, 442; '92, 416.

**ENGINEERS IN CHARGE.**

Maj. G. J. Lydecker, 1882-'89. Report, '88, 2755.

Col. J. M. Wilson, 1889-'90. Report, '89, 2817.

Lieut. Col. G. H. Elliot, 1890-'—. Reports, '90, 3531; '91, 3904; '92, 3381.

**ASSISTANT.**

Lieut. C. McD. Townsend. Reports, '88, 2764; '89, 2819.

**Operations.**

1887-'88. Work on tunnel for aqueduct extension continued, '88, 2756. Excavation and slope paving of new reservoir completed, '88, 2761.

1888-'89. Work on tunnel for aqueduct extension continued, '89, 2817.

1889-'91. Operations suspended, '90, 3531; '91, 3904.

1891-'92. Repairs to existing works, '92, 3381.

**WASHINGTON, D. C.—Continued.****Projects.**

By Maj. Lydecker, 1883, for increasing the water supply of Washington by extension of Washington Aqueduct from distributing reservoir near Drovers Rest to site of new reservoir near Howard University by a tunnel 20,715 feet long; extension of dam at Great Falls of Potomac across Conns Island and Virginia Channel; construction of new distributing reservoir in valley east of Howard University, and laying mains from reservoir to center of distribution, '84, 2301.

**Surveys.****MAPS.**

'88, 2766; '89, 2318.

**WASHINGTON, D. C.—WATER SUPPLY.****Appropriations.**

1889..... \$575,000, '89, 2824.

**Contracts.**

1889. Gloucester Iron Works, for iron pipe, at \$26.57 per ton; Camden Iron Works, for iron pipe, at \$27.38 per ton; Mohawk and Hudson Manufacturing Company, for valves (48-inch to 6-inch), at from \$1,125 to \$13; McNeal Pipe and Foundry Company, for special castings, at \$56 per ton; Springman & Bro., for hauling pipe, at 80 cents per ton; T. B. Coyle, for trench excavation, at 24 cents per cubic yard for earth, and \$2.70 per cubic yard for rock; Clendenin Bros., for lead, at 4½ cents per pound; R. A. Robbins, for jute, at 11.4 cents per pound, '89, 2821.  
1890. Mellert Foundry and Machine Company, for cast-iron water pipe, at \$35,091, '91, 3902. Mellert Foundry and Machine Company, for cast-iron water pipe, at \$2,620, '91, 3903. G. W. Knox, for hauling pipe, at 70 cents per ton, '91, 3903. Camden Iron Works, for pipe and castings, at \$23.80 per ton, '91, 3903.  
1891. G. W. Knox, for hauling pipe, at 65 cents per ton, '91, 3904.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 379; '90, 346; '91, 441; '92, 416.

**ENGINEERS IN CHARGE.**

Col. J. M. Wilson, 1889-'90. Report, '89, 2820.

Lieut. Col. G. H. Elliot, 1890-'—. Reports, '90, 3522; '91, 3897; '92, 3380.

**ASSISTANT.**

Lieut. C. McD. Townsend. Report, '89, 2824.

**Legislation.**

Act of Congress, March 2, 1889, providing for a water supply for the District of Columbia, '89, 2820.

**Operations.**

1888-'89. Laying of water mains in progress, '89, 2821.  
1889-'90. Laying of water mains completed, '90, 3523.  
1890-'91. Further pipe laying in progress, '91, 3898.  
1891-'92. Operations completed, '92, 3380.

**Surveys.**

Location of the 30-inch and 48-inch mains, '90, 3530; '91, 3901.

**WATEREE RIVER, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 549.)

**Appropriations.**

1881-'87 .....	\$35,500
1888 .....	12,000, '88, 941.
1890 .....	12,500, '90, 1223.
1892 .....	2,500, '92, 1215.

Total .....	62,500
List of appropriations, '92, 1215.	

**WATEREE RIVER, S. C.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 132; '89, 155; '90, 139; '91, 174, 179, 1487; '92, 172.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'89. Report, '88, 939.

Capt. F. V. Abbot, 1889-'—. Reports, '89, 1189; '90, 1222; '91, 1462, 1488; '92, 1214.

**ASSISTANT.**

R. Whitford. Reports, '88, 941; '89, 1191; '90, 1223; '91, 1463; '92, 1216.

**Obstructions.**

Obstruction of the river by bridges without drawspans, '88, 940.

**Operations.**

1887-'88. No operations for lack of funds, '88, 940.

1888-'89. Operations postponed awaiting introduction of drawspans in bridges over the river, '89, 1190.

1889-'90. 275 logs and stumps and 5 cords of snags removed from the river, and 350 trees removed from the banks, '90, 1223.

1890-'91. 2,413 logs and snags and 56 cords of small snags removed from the channel, and 2,108 trees and 80 cords of brush cleared from the banks, '91, 1463.

1891-'92. 1,740 snags and 40 cords of small snags removed from the channel, and 1,806 trees and 29 cords of brush cleared from the banks, '92, 1216.

**Plans.**

After examination in 1891 to determine the advisability of making a cut-off across the neck of a bend in the Wateree River, about 4 miles below Camden, Capt. Abbot reported that the interests of navigation did not demand such an improvement, '91, 1488.

**Projects.**

By Capt. Phillips, 1880, to secure a 4-foot navigation between the mouth and Camden, a distance of 68 miles, by removal of snags, stumps, and similar obstructions, and removal of fallen and leaning trees from the banks; estimated cost, \$29,552, '80, 915, 916. Increased in 1881, 1885, and 1887, on account of inadequate appropriations, to \$60,000, '81, 1034; '85, 1124; '87, 1089. Total amount appropriated from 1881 to 1886, inclusive, \$35,500; amount estimated to complete project, \$24,500, '87, 1091; '92, 1214.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Abbot, '91, 1488.

**MAPS.**

'89, 1190.

**WATER GAUGES ON THE MISSISSIPPI RIVER.—(See MISSISSIPPI RIVER, WATER GAUGES ON.)****WATCH HILL COVE, R. I.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 62.

**ENGINEER IN CHARGE.**

Maj. W. R. Livermore, 1890. Report, '91, 735.

**Physical Characteristics.**

Description of the locality, '91, 735.

**Plans.**

Maj. Livermore did not consider the locality worthy of improvement, '91, 735.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Livermore, '91, 735.

**WAUKEGAN HARBOR, ILL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 550.)

**Appropriations.**

1852-'87 .....	\$105,000
1888.....	25,000, '88, 1868.
1890.....	35,000, '90, 2364.
1892.....	25,000, '92, 2212.

Total ..... 190,000

List of appropriations, '92, 2212.

**Contracts.**

1888. Green Bay Dredge and Pile Driver Company, for dredging, at 12 cents per cubic yard, '89, 2084.

1890. J. M. Laurie, for stone ballast, at \$7 per cord; G. Kirk &amp; Son, for pine plank, at \$19.50 per M feet; Cairo Lumber Company, for oak timber, at \$24.50 per M feet; Chicago Forge and Bolt Company, for rods, bolts, and spike, at 2½ cents per pound; F. Bairstow, for coal, at \$4.25 per ton, '91, 2570.

1892. Green Bay Dredge and Pile Driver Company, for dredging, at 13½ cents per cubic yard, '92, 2212.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 245; '89, 284; '90, 256; '91, 327; '92, 313.

**ENGINEERS IN CHARGE.**

Capt. W. L. Marshall, 1884-'89. Report, '88, 1867.

Maj. C. E. L. B. Davis, 1889-'92. Reports, '89, 2081; '90, 2361; '91, 2568.

Maj. J. F. Gregory, 1892-'— . Report, '92, 2209.

**ASSISTANT.**

W. H. Hearing. Report, '88, 1868.

**Operations.**

1887-'88. 71 linear feet of south pier completed and pier filling replaced by hired labor, '88, 1867.

1888-'89. 177 linear feet of south pier built by hired labor; 17,805 cubic yards material dredged under contract, '89, 2083.

1889-'90. 63,069 cubic yards material dredged; 60 cubic yards stone placed in south pier, '90, 2360.

1890-'91. North pier extension in progress; 192 linear feet built, '91, 2570.

1891-'92. 200 linear feet of north pier extension built; 304 linear feet of sand fence built; 9,715 cubic yards of material dredged, '92, 2211.

**Projects.**

In 1855, under the appropriation of \$15,000 of 1852, one crib was placed in line of proposed breakwater, which was subsequently destroyed, '73, 247; '80, 1942.

By Lieut. Col. Houston, 1879, for formation of a harbor of refuge at Waukegan by 2,590 linear feet of pile-pier construction, inclosing a basin of 16 acres and a dock front of 1,260 feet, the basin to be dredged to a depth of 12 feet, with the ultimate formation of an inner basin; estimated cost, \$110,000, '80, 1943, 1946. Increased \$50,000 in 1883, '83, 1711, and \$20,000 in 1886, '86, 1686. From 1880 to 1886, inclusive, \$90,000 was appropriated, when it was estimated that \$71,000 would be required to complete project, '87, 2075.

In 1889 Maj. Davis proposed the extension of both piers 500 feet farther into the lake, at an estimated cost of \$75,000; this, together with \$71,000, the amount estimated in 1887 for completion of project, makes \$146,000 for completion of improvement, '89, 2083, 2084; '92, 2209.

**Surveys.****MAPS.**

'89, 2084.

**WEIR RIVER, MASS.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '89, 43.

**ENGINEER IN CHARGE.**

Lieut. Col. S. M. Mansfield, 1888. Report, '89, 597.

**Physical Characteristics.**

Description of the locality, '89, 597.

**WEIR RIVER, MASS.—Continued.****Plans.**

By Lieut. Col. Mansfield, 1888, for improvement of the channel entrance by rock removal and buoyage; estimated cost, \$7,000, '89, 599.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of Lieut. Col. Mansfield, '89, 597.

**WELFLEET HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 552.)

**Appropriations.**

1872-'87 .....	\$5,000
1888 .....	7,000, '88, 588.
1890 .....	4,000, '90, 513.

Total ..... 16,000

**Commerce.**

Value of fishermen's yield, '88, 476, 477.

**Contracts.**

A. R. Wright, for dredging, at 42 cents per cubic yard, and removal of bowlders weighing over 3 tons, at \$10 per cubic yard, '89, 588.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 31, 32; '89, 42; '90, 36; '91, 44; '92, 50.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1888-'89. Report, '88, 476, 477.

Lieut. Col. S. M. Mansfield, 1889-'—. Reports, '89, 587; '90, 512; '91, 663; '92, 591.

**ASSISTANT.**

S. Haagensen. Report, '88, 479.

**Operations.**

1887-'89. No operations, '88, 476; '89, 588.

1889-'90. 16,984 cubic yards material dredged, '90, 512.

1890-'92. No operations, '91, 604; '92, 592.

**Projects.**

For project prior to 1888 see '89, 587.

By Lieut. Col. Gillespie, 1888, for improvement of the harbor by the excavation of a channel 4,200 feet long, 100 feet wide at bottom, and 6 feet deep, mean low water, from the Deep Hole to the wharves; estimated cost, \$24,000, '88, 476; '89, 587; '92, 591. Increased in 1889, on account of rise in prices, to \$38,000, '89, 588.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Gillespie, '88, 477.

**MAPS.**

'88, 478.

**WESTERN RIVERS.—REMOVING SNAGS AND OBSTRUCTIONS FROM.**

(See MISSISSIPPI RIVER, MISSOURI RIVER, AND ARKANSAS RIVER.)

**WESTPORT HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 552.)

**Appropriations.**

1886-'87 .....	\$1,000
1890 .....	1,000, '91, 707.
1892 .....	1,000, '92, 613.

Total ..... 3,000

**WESTPORT HARBOR, MASS.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 36; '89, 55; '91, 52, 80; '92, 56.

**ENGINEERS IN CHARGE.**

Maj. W. R. Livermore, 1887-'92. Reports, '88, 491; '89, 645; '91, 706.

Col. D. C. Houston, 1891-'92. Report, '91, 840.

Capt. W. H. Bixby, 1892-'— . Report, '92, 612.

**Operations.**

1887-'88. Improvement completed by construction of a brush jetty at Horse Neck Point, '88, 492.

1888-'91. No operations, '91, 706.

1891-'92. 230 tons of stone used in reconstruction of Horse Neck Jetty, '91, 612.

**Physical Characteristics.**

Location of the harbor, '88, 491; '89, 645.

**Plans.**

By Col. Houston, 1891, for excavation of a channel 100 feet wide and 6 feet deep at mean low water between Saugatuck and Westport; estimated cost, \$40,000, with an annual cost of \$2,000 for maintenance; estimated cost of a 4-foot channel 60 feet wide up to Westport, \$10,000, '91, 842.

**Projects.**

By Maj. Warren, 1878, for the protection of Horse Neck Point from erosion by the construction of jetties at that point; estimated cost, \$1,000, '86, 592; '87, 543.

By Maj. Livermore, 1888, for further improvement of the harbor by extension of the jetty on Horse Neck Point, and dredging; estimated cost, \$2,000, '89, 646; '91, 706.

**Surveys.**

Examination of Westport Harbor and east and west branches of Westport River ordered by act of August 11, 1888. Made, 1888, under direction of Maj. Livermore, '89, 645.

Examination of Saugatuck River ordered by act of September 19, 1890. Made, 1891, under direction of Col. Houston, '91, 840.

**WESTCHESTER CREEK, N. Y.—SURVEY OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 94.

**ENGINEER IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1890. Report, '91, 954, 955.

**ASSISTANT.**

G. W. Kuehnle. Report, '91, 957.

**Physical Characteristics.**

Description of the locality, '91, 954.

**Plans.**

By Lieut. Col. Gillespie, 1891, for excavation of a navigable channel 100 feet wide and 8 feet deep at mean low water across the estuary, thence 80 feet wide and 8 feet deep to a point 1,000 feet above Scrivens Dock, and thence 60 feet wide and 8 feet deep to the head of navigation; estimated cost, \$27,500, '91, 956.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Gillespie, '91, 955.

**WEST NECK RIVER, VA.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 153.

**ENGINEER IN CHARGE.**

Capt. G. J. Fiebeger, 1891. Report, '91, 1324.

**ASSISTANT.**

J. P. White. Report, '91, 1326.

**Physical Characteristics.**

Description of the locality, '91, 1325.



**WEST NECK RIVER, VA.—Continued.****Plans.**

In 1891 Capt. Fiebeger considered the river worthy of improvement as far as Owens Bridge. The improvement proposed contemplates straightening and enlarging the channel, removing snags and similar obstructions, and the formation of a turning basin, at an estimated cost of \$9,000. The river above Owens Landing was not considered worthy of improvement, '91, 1325.

**Surveys.**

Examination made, 1891, under direction of Capt. Fiebeger, '91, 1324.

**WETIPKIN RIVER, MD.—EXAMINATION OF.**

(Continued from Vol. II, p. 553.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '89, 112.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1889. Report, '89, 910.

ASSISTANT.

A. Stierle. Report, '89, 910.

**Physical Characteristics.**

Description of the locality, '89, 910.

**Plans.**

In 1889 Col. Craighill did not consider the river as worthy of improvement, '89, 910.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1888, under direction of W. F. Smith, '89, 910.

**WEYMOUTH RIVER, MASS.—IMPROVEMENT OF.****Appropriations.**

1890..... \$10,000, '91, 656.

1892..... 10,000, '92, 585.

Total ..... 20,000

**Commerce.**

Saving in freight charges to be derived from improvement, '90, 521; '91, 682.

**Contracts.**

1890. A. R. Wright, for dredging, at 37½ cents per cubic yard, and removal of boulders, at \$9 each, '91, 656.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 44; '90, 38; '91, 42, 47; '92, 48.

ENGINEER IN CHARGE.

Lieut. Col. S. M. Mansfield, 1888-'—. Reports, '90, 521; '91, 655; '92, 584.

ASSISTANT.

S. Haagensen. Reports, '90, 522; '91, 683.

**Operations.**

1890-'91. 18,389 cubic yards material dredged, '91, 655.

1891-'92. 5,585 cubic yards material dredged, '92, 585.

**Physical Characteristics.**

Description of the locality, '90, 523; '91, 682.

**Plans.**

By Lieut. Col. Mansfield, 1891, for excavation of a channel through the outer bar 200 feet wide and 12 feet deep at mean low water, and also widening and deepening the natural channel of the river to the same dimensions up to the wharf of the Fertilizer Company; estimated cost, \$22,000, '91, 683.

**Projects.**

By Lieut. Col. Mansfield, 1889, for improvement of the river from Quincey Point to East Braintree by dredging a channel 7,000 feet long, from 50 to 100 feet wide, and 6 feet deep at mean low water; estimated cost, \$40,000, '90, 522; '92, 584.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of Lieut. Col. Mansfield, '90, 522.

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Lieut. Col. Mansfield, '91, 683.

**WHITE RIVER, ARK.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 553.)

**Appropriations.**

1874-'87 .....	\$166,000
1888 .....	25,000, '88, 1403.
1890 .....	30,000, '90, 1946.
1892 .....	75,000, '92, 1686.
Total .....	296,000

**Commerce.**

Prospective advantages to result from improvement, '89, 1657; '90, 1944; '92, 1685.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 188; '89, 221; '90, 199; '91, 232; '92, 244.

**ENGINEER IN CHARGE.**

Capt. H. S. Taber, 1884— Reports, '88, 1403; '89, 1655; '90, 1942; '91, 2048; '92, 1683.

**Operations.**

1887-'88. Snags and logs removed near Dewalls Bluff and Clarendon, '88, 1404.

1888-'89. Six barges, pile driver, and quarter boat built; snagging operations begun, '89, 1656.

1889-'90. 620 linear feet of dam repaired; 2,440 linear feet of dam built; 367 cubic yards of rock blasted and removed, '90, 1943.

1890-'91. 1,460 linear feet of dam work built, and 11 cubic yards of rock removed from the channel, '91, 2048.

1891-'92. 2,844 cubic yards of rock and 510 cords of brush used in dam construction, '92, 1684.

**Projects.**

A project for the improvement of the river between Jacksonport and Buffalo, made in 1871-'72, proposed the removal of snags, logs, and rock, and the improvement of shoals by the construction of wing dams, '71, 370; '72, 376; '80, 1314; '85, 1592.

The improvement of the river at Buffalo Shoals was proposed to be accomplished by removal of bowlders and the construction of 7 spur dikes, '78, 661.

From 1874 to 1879, inclusive, \$70,000 was appropriated for the improvement of the river above Jacksonport, '74, 1, 63; '76, 1, 80; '79, 115.

In 1887 it was estimated that, pending plans and estimates for the permanent improvement of the river, a yearly appropriation of \$8,000 for the removal of snags would be required for one or two years, '87, 308, 1530.

By Capt. Taber, 1888, for permanent improvement of the river, giving a minimum depth of 5 feet at extreme low water from the mouth to Newport, and a depth of 2 feet at low water from Newport to Buffalo Shoals, by construction of spur dikes to contract the flow, and by removal of obstructions; estimated cost, \$105,315, '88, 1407-1412.

**WHITE RIVER, IND.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 556.)

**Appropriations.**

1879-'87 .....	\$102,500
1888 .....	5,000, '88, 1745.
1892 .....	5,000, '92, 2037.

Total ..... 112,500

**Contracts.**

1887. M. Cox, for dredge hull, at \$995, '88, 1746.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 221; '89, 258; '90, 232; '91, 298; '92, 285.

**ENGINEERS IN CHARGE.**

Maj. A. Stickney, 1886-'89. Reports, '88, 1745; '89, 1937.

Capt. E. Maguire, 1890. Report, '90, 2234.

Lieut. Col. G. J. Lydecker, 1891— Reports, '91, 2409; '92, 2037.

**ASSISTANT.**

O. L. Petitdidier. Reports, '88, 1746; '89, 1938; '90, 2235; '91, 2410; '92, 2038.

**WHITE RIVER, IND.—Continued.****Operations.**

- 1887-'88. 5,190 cubic yards rock removed, '88, 1745.  
 1888-'89. 7,835 cubic yards rock removed, '89, 1938.  
 1889-'90. No operations, '90, 2234.  
 1890-'91. No operations, '91, 2409.  
 1891-'92. 350 linear feet of guiding dike built at Kellys Ripple, '92, 2038.

**Projects.**

By Maj. Smith, 1879, for the formation of a channel with a clear depth of 2 feet from the mouth to Portersville on the East Fork and Falls on the West Fork, by removal of snags and deepening channel by wing dams and dikes, '79, 148, 1454; '81, 2007.

Modified in 1880 to obtain a channel  $3\frac{1}{2}$  feet deep from mouth to Hazelton by rock removal at Kellys Ripple, dike construction, and removal of snags, '80, 1843; '87, 279.

From 1879 to 1886, inclusive, \$102,500 was appropriated; amount estimated to complete project, \$17,500, '87, 247.

**WHITE RIVER HARBOR, MICH.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 555.)

**Appropriations.**

1867-'87 .....	\$247, 550
1888 .....	10, 000, '88, 1901.
1890 .....	17, 000, '90, 2635.
1892 .....	5, 000, '92, 2333.

Total ..... 279, 550

List of appropriations, '92, 2332.

**Contracts.**

1889. Stephen Bedford, for white pine timber, at \$21 per M feet, B. M., '89, 2180. Geer & Crawford, for edgings, at \$2.50 per cord, '89, 2180. Chicago and Lemont Stone Company, for stone, at \$8.24 per cord, '89, 2180. Parkhurst & Williamson, for drift bolts, at 2 cents per pound, '89, 2180.

1890. E. G. Crosby, for edgings, at \$2 per cord, '90, 2635.

1891. Gaylord & Wing, for white pine plank, at \$15 per M feet; G. W. Crouter, for spike, at 3 cents per pound; E. G. Crosby, for edgings, at \$2 per cord, and F. A. Hagen, for stone, at \$2.24 per cord, '91, 2688.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 254; '89, 298; '90, 268; '91, 339; '92, 325.

**ENGINEERS IN CHARGE.**

Maj. S. M. Mansfield, 1888-'89. Report, '88, 1908.

Maj. W. Ludlow, 1889-'— . Reports, '89, 2179; '90, 2634; '91, 2687; '92, 2331.

**Operations.**

1887-'88. 300 linear feet of old north pier superstructure removed; 4,190 cubic yards material dredged from the harbor, '88, 1909.

1888-'89. 6,343 cubic yards sand dredged, '89, 2179.

1889-'90. 714 linear feet sand fence built; 6,313 cubic yards material dredged, '90, 2634.

1890-'91. Repairs and new superstructure to 377 linear feet of south pier; repairs to outer end of north pier, '91, 2687.

1891-'92. Repairs to piers and superstructure construction continued, '92, 2332.

**Physical Characteristics.**

Description of the locality, '90, 2634.

**Projects.**

By Maj. Wheeler, 1866, to secure a channel 200 feet wide and 12 feet deep connecting Lake White and Lake Michigan, the channel to be maintained by pile protection and crib piers; estimated cost, \$170,530, '66, iii, 13; iv, 144, 145. Estimate increased, 1873, to \$220,445, '84, 1982.

By Capt. Lockwood, 1884, for extension of south pier 200 feet and north pier 250 feet, and dredging between piers; estimated cost, \$104,225, '84, 1982. From 1867 to 1886, inclusive, \$247,550 was appropriated.

In 1887 it was estimated that \$84,225 would be required to complete the project, '87, 2188.

**WHITE OAK RIVER, N. C.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 148; '90, 170.

ENGINEER IN CHARGE.

Capt. W. H. Bixby, 1888-'91. Reports, '89, 1127; '91, 1434.

**Physical Characteristics.**

Description of the locality, '89, 1127.

**Plans.**

By Capt. Bixby, 1889, for securing navigation for steamboats from the ocean to Sabistons Bridge, a distance of 29 miles, and thence a channel for flats about 21 miles farther to Collins Ford; estimated cost, \$45,000, '89, 1129.

By Capt. Bixby, 1890, for a steamboat navigation from Roberts Landing to Sabistons Bridge, and a flatboat navigation from thence to Collins Crossing; estimated cost, \$4,550, '91, 1435.

**Surveys.**

Examination ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Bixby, '89, 1127.

Examination, from Roberts Landing to Collins Crossing, ordered by act of September 19, 1890. Made, 1890, under direction of Capt. Bixby, '91, 1434.

**WICOMICO RIVER, MD.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 557.)

**Appropriations.**

1872-'84 .....	\$50,000
1890 .....	10,000, '91, 1194.
1892 .....	6,500, '92, 975.

Total .....	66,500
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List of appropriations, '88, 751.

**Commerce.**

Commercial interests to be furthered by improvement, '90, 948, 949.

**Contracts.**

1891. F. C. Somers, for dredging, at 12 cents per cubic yard, '91, 1194.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '89, 112; '90, 102; '91, 128; '92, 128.

ENGINEER IN CHARGE.

W. F. Smith, U. S. agent, 1887-'—. Reports, '88, 751; '90, 947; '91, 1193; '92, 975.

ASSISTANT.

A. Stierle. Report, '90, 947, 950.

**Operations.**

1887-'88. No operations since 1885, at which time the project was completed, '88, 751.

1888-'91. No operations, '91, 1194.

1891-'92. 65,918 cubic yards material dredged, '92, 975.

**Plans.**

By W. F. Smith, U. S. agent, 1889, for improvement of the Wicomico River by excavation of a 9-foot low-water channel from the natural 9-foot curve to the drawbridge at the town of Salisbury, involving the removal of about 116,000 cubic yards of material; estimated cost, \$23,200, '90, 950.

**Projects.**

By Lieut. Col. Craighill, 1871, for the formation of a channel 70 feet wide and 7 feet deep at low water from the mouth to the town of Salisbury, part of the dikes to be built by private parties, '71, 661, 663; '72, 685; '75, ii, 70.

In 1884 the project was modified to give increased width to the channels and to straighten them at bends, '84, 959; '87, 96.

The work was completed in 1885 under aggregate appropriations of \$50,000, '87, 844.

By W. F. Smith, 1890, for excavation of a 9-foot low-water channel from the natural 9-foot depth in the river below to the drawbridge at Salisbury, the channel width to be 150 feet; estimated cost, \$23,200, '90, 948.

**Surveys.**

Ordered by act of August 11, 1888. Made, 1889, under direction of W. F. Smith, U. S. agent, '90, 947, 950.

**WICOMICO RIVER (GREAT), VA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 146.

ENGINEER IN CHARGE.

Lieut. Col. P. C. Hains, 1891. Report, '91, 1288.

**Physical Characteristics.**

Description of the locality, '91, 1288.

**Plans.**

In 1891 Lieut. Col. Hains did not consider the trade of the locality sufficient to warrant an improvement, '91, 1288.

**Surveys.**

Examination made, 1891, under direction of Lieut. Col. Hains, '91, 1288.

**WILLAMETTE RIVER, OREG.—SURVEY FOR IMPROVEMENT AT CLACKAMAS RAPIDS, ROSS ISLAND, AND CORVALLIS CITY.****Engineers.**

CHIEF OF ENGINEERS.

Reports, '91, 421; '92, 393.

ENGINEER IN CHARGE.

Maj. T. H. Handbury, 1892. Report, '92, 2840, 2842, 2844, 2847.

**Physical Characteristics.**

Description of the river at Ross Island and Clackamas Rapids, '92, 2842, 2844.

**Plans.**

By Maj. Handbury, 1891, for formation of a channel 100 feet wide and 14 feet deep at low water at Ross Island by dredging, closing chutes, and works of contraction; for improvement at Clackamas Rapids by removal of the old dam at the head of the rapids, and the construction of 6,800 linear feet of dike for the contraction and direction of the current; for improvement at Corvallis by removal of snags and similar obstructions; estimated cost, \$138,900, '92, 394.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Handbury, '92, 2842, 2844, 2847.

**WILLAMETTE RIVER, OREG.—EXAMINATION FOR DEEPENING CHANNEL ON WEST SIDE OF SWAN ISLAND.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 3374.

ENGINEER IN CHARGE.

Maj. T. H. Handbury, 1890. Report, '91, 3374.

**Plans.**

In 1890 Maj. Handbury did not consider the locality worthy of improvement, '91, 2373.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Handbury, '91, 3374.

**WILLAMETTE RIVER, OREG., below Portland.—(See COLUMBIA RIVER, (LOWER) OREG.)****WILLAMETTE RIVER (UPPER), OREG.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 558.)

**Appropriations.**

1871-'87 .....	\$155,500
1888.....	29,000, '88, 2188.
1890.....	11,000, '90, 3063.
1892.....	* 30,000, '92, 2837.

Total ..... 225,500  
 List of appropriations, '91, 3369.

\*Of which \$3,000 is to be used in improvement of Yamhill River, '92, 2837.

**WILLAMETTE RIVER (UPPER), OREG.—Continued.****Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 305; '89, 363; '90, 328; '91, 417; '92, 391.

**ENGINEERS IN CHARGE.**

Maj. W. A. Jones, 1884-'90. Reports, '88, 2187; '89, 2576, 2579.

Maj. T. H. Handbury, 1890-'— . Reports, '90, 3061; '91, 3368; '92, 2835.

**Operations.**

1887-'88. No operations, '88, 2187.

1888-'89. 2,364 linear feet of pile dike built; 1,676 linear feet of bank revetted; 6,720 cubic yards of bank excavated and 810 piles driven; 825 snags removed, '89, 2578.

1889-'90. Snagging operations continued, '90, 3062.

1890-'91. 35 snags and 20 overhanging trees removed, '91, 3368.

1891-'92. 577 snags removed, '92, 2836.

**Physical Characteristics.**

Description of the river, '89, 2579.

**Projects.**

The project for the improvement of the Upper Willamette River, between Portland and Corvallis, a distance of 114 miles, was adopted in 1870, and consisted in removal of snags and the improvement of the channel at rapids by scraping, removal of wreck, boulders, and gravel, and the construction of wing dams, '71, 905; '80, 2284. From 1871 to 1877 \$71,500 was appropriated, '78, 1329.

In 1878 a project was submitted for the construction of cut-off and wing dams above Corvallis, the construction of a new snag boat, and the improvement of the rapids at Bisells and Loves Rocks; estimated cost, \$80,000, '78, 1329.

In 1886, an aggregate of \$155,500 having been appropriated, it was estimated that \$29,000 would be required to complete the project, '86, 1941.

In 1889 Maj. Jones proposed the improvement of the reach between Portland and Oregon City by construction of a riprap dike 6,000 feet in length to protect the Willamette from the debris brought down by the Clackamas River, and the excavation of a channel with a low-water depth of 8 feet and a width of 150 feet; estimated cost, \$60,000, '89, 2581, 2582.

**WILMINGTON HARBOR, CAL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 559.)

**Appropriations.**

1871-'87 .....	\$780,000
1888 .....	90,000, '88, 2113.
1890 .....	34,000, '90, 2901.
1892 .....	51,000, '92, 2627.

Total ..... 955,000

List of appropriations, '92, 2627.

**Contracts.**

1890. R. Axman, for dredging, at 55 cents per cubic yard, '90, 2901. P. O'Neil, for rock, at \$2.27 per ton, '91, 2957.

1891. A. A. Polhamus, for rock, at \$2.09 per ton, '91, 2958.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 292; '89, 346; '90, 312; '91, 391; '92, 368.

**ENGINEER IN CHARGE.**

Lieut. Col. W. H. H. Benyaurd, 1886-'— . Reports, '88, 2111; '89, 2474; '90, 2900; '91, 2956; '92, 2626.

**ASSISTANT.**

Lieut. J. J. Meyler. Report, '91, 2958.

**Operations.**

1887-'88. 8,198 tons stone delivered in west jetty; dredging of inner channel begun, '88, 2112.

1888-'89. Part of jetty on east side of the harbor raised and strengthened; repairs to plant, '89, 2475.

1889-'90. 13,498 cubic yards material dredged from inner channel, '90, 2901.

1890-'91. 62,295 cubic yards material dredged; 15,123 tons stone delivered in west jetty, '91, 2957.

**WILMINGTON HARBOR, CAL.—Continued.****Operations—Continued.**

1891-'92. 21,309 tons of rock deposited in extending east jetty and in strengthening west jetty, '92, 2626.

**Projects.**

By Lieut. Col. Mendell, 1871, for protection of harbor and channel entrance at Wilmington by construction of 6,700 linear feet of timber and stone break-water; estimated cost, \$400,000, '71, 947. For protection of work, \$30,000, '74, ii, 370. For completion, \$100,000, '76, ii, 617; '80, 2232.

By Lieut. Col. Mendell, 1881, for an increase in channel depth from 10 feet to 15 feet at low water by excavation of the reef to a width of 400 feet, extension of jetties beyond Deadmans Island in the Bay of San Pedro to a depth of 18 feet, excavation of sand between jetties, and the elevation of existing works to 2 feet above high water; estimated cost, \$291,766, '81, 2467; '86, 1912. Causes for increased cost, '85, 2335, 2336; '86, 1913. From 1871 to 1886, inclusive, \$780,000 has been appropriated; estimated cost of completion of project, \$175,000, '86, 1914; '87, 2430.

**Surveys.**

Hydrographic survey of harbor made, 1888, under direction of Lieut. Col. Benyaurd, '88, 2112.

**WILMINGTON HARBOR, DEL.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 560.)

**Appropriations.**

1836-'87 .....	\$259,606
1888.....	30,000, '88, 740.
1890.....	30,000, '90, 919.
1892.....	40,000, '92, 947.

Total ..... 359,606

List of appropriations, '88, 740.

**Contracts.**

1889. National Dredging Company, for dredging, at 14 cents per cubic yard, '90, 920; Ira Lunt, for jetty repair, '90, 920.

1891. Atlas Dredging Company, for dredging, at 8 cents per cubic yard, '91, 1137.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 87; '89, 103; '90, 93; '91, 119; '92, 120.

**BOARD OF ENGINEERS.**

Commission constituted by S. O. No. 66, at Philadelphia, Pa., June 18, 1891, to consider and report upon the improvement of Wilmington Harbor. Report, '91, 1138. (Col. Houston, Maj. Raymond, and L. Y. Schermerhorn, C. E.)

**ENGINEERS IN CHARGE.**

W. F. Smith, U. S. agent, 1885-'— Reports, '88, 739; '89, 881; '90, 917; '91, 1136; '92, 946.

**Operations.**

1887-'88. Dredging under contract with American Dredging Company completed, '88, 739.

1888-'89. No operations, '89, 882.

1889-'90. 165,214 cubic yards material dredged; repairs made to jetty, '90, 918.

1890-'91. 235,340 cubic yards material dredged, '91, 1136.

1891-'92. 67,645 cubic yards material dredged, '92, 946.

**Plans.**

By Commission, 1891, for the permanent improvement of the harbor by (1) altering the sewerage system of Wilmington so as to prevent the discharge of solid matter into Christiana River; (2) rectifying the channel at the mouth of the river by the construction of 1,400 linear feet of earth and stone jetty and 1,200 linear feet of pile and stone dike on the south side of the entrance; (3) rectification of the channel at the junction of the Brandywine and Christiana by the construction of 600 linear feet of high-water dike; (4) by dredging a channel 150 feet wide and 15 feet deep at mean low water from the mouth to the Pulp Works; (5) the channel thus excavated to be maintained either by further dredging or the construction of a flushing reservoir; total estimated cost of improvement, exclusive of the reservoir, \$192,000, or inclusive of the same, \$392,000, '91, 1138, 1159.

**WILMINGTON HARBOR, DEL.—Continued.****Projects.**

By Lieut. Col. Kurtz, 1870, for securing channel in Christians River, from 100 to 200 feet wide and 12 feet deep at low water, by dredging and blasting: estimated cost, \$83,000, '74, ii, 137. Increased by Col. Macomb, 1879, to \$93,000, '79, 441. Completed at a cost of \$83,500, '81, 769.

By Col. J. N. Macomb, 1881, for construction of jetty at harbor entrance, dredging 15-foot channel from entrance to Pulp Works, and 12-foot channel from thence to Delaware Railroad Bridge; estimated cost, \$175,551, '81, 770, 774. Increased, 1883, by Lieut. Col. G. Weitzel to \$191,384, for a channel 150 feet wide and 15 feet deep from mouth to Delaware Railroad Bridge, '83, 622. The project was modified in 1884, providing for an additional height to the jetty of 4 feet and to extend it 322 feet in length, '89, 882; '91, 1136.

**WILSON HARBOR, N. Y.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 561.)

**Appropriations.**

1875-'87 .....	\$60,000
1888 .....	5,000, '88, 2058.
Total .....	65,000

**Contracts.**

1889. McCollum & Lee, for dredging, at 20 cents per cubic yard, '89, 2397.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 280; '89, 331; '90, 300; '91, 376; '92, 355.

**ENGINEERS IN CHARGE.**

Capt. F. A. Mahan, 1886-'90. Reports, '88, 2057; '89, 2395.

Maj. A. Stickney, 1890-'92. Reports, '90, 2842; '91, 2891.

Maj. E. H. Rufiner, 1892-'—. Report, '92, 2534.

**Operations.**

1887-'88. 80 feet of east pier rebuilt by hired labor, and minor repairs made to east and west piers, '88, 2057.

1888-'89. Construction of stone protection begun; 150 linear feet of west pier rebuilt; 24,930 cubic yards material dredged, '89, 2397.

1889-'91. No operations, '90, 2842; '91, 2892.

1891-'92. Repairs to lake end of west pier, '92, 2534.

**Projects.**

By Maj. Wilson, 1873, for extension of the piers to 12 feet, and dredging in the channel 12 feet deep between the piers; estimated cost, \$90,000, '73, 392; '75, i, 58, 323; '76, ii, 575, 576.

By Lieut. Col. McFarland, 1877, for dredging, increasing the estimated cost to \$100,000, '77, 975.

From 1875 to 1886, inclusive, \$60,000 had been appropriated, '87, 306.

**Surveys.****MAPS.**

'89, 2398.

**WILSON POINT HARBOR, CONN.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 365.)

**Appropriations.**

1888 .....	\$25,000, '91, 72.
1890 .....	30,000, '91, 791.
Total .....	55,000

**Contracts.**

1891. A. J. Beardsley & Son, for dredging, at 8½ cents per cubic yard, '91, 790.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '91, 72; '92, 76.

**ENGINEER IN CHARGE.**

Col. D. C. Houston, 1890-'—. Reports, '91, 789; '92, 695.



**WILSON POINT HARBOR, CONN.—Continued.****Operations.**

1890-'91. 124,974 cubic yards material dredged, '91, 790.

1891-'92. 54,026 cubic yards material dredged, '92, 696.

**Physical Characteristics.**

Description of the locality, '91, 789.

**Projects.**

By Col. Houston, 1888, for excavation of a channel 15 feet deep and 300 feet wide up the harbor to the vicinity of the railroad wharves; estimated cost, \$52,900, '91, 790.

**WINTHROP HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 562.)

**Appropriations.**

1888 .....	\$1, 000, '88, 468.
1890 .....	5, 000, '90, 497.
1892 .....	3, 000, '92, 575.

Total ..... 9, 000

**Contracts.**

1890. Boynton Bros., for dredging, at 24 cents per cubic yard, '91, 645.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 27, 32; '89, 37; '90, 32; '91, 40; '92, 46.

**ENGINEERS IN CHARGE.**

Lieut. Col. G. L. Gillespie, 1888-'89. Report, '88, 468, 470.

Lieut. Col. S. M. Mansfield, 1889-'— . Reports, '89, 571; '90, 496; '91, 644; '92, 574.

**ASSISTANT.**

S. Haagensen. Report, '88, 471.

**Operations.**

1887-'90. No operations, '88, 468; '89, 571; '90, 497.

1890-'91. 20,060 cubic yards material dredged, '91, 644.

1891-'92. No operations, '92, 574.

**Projects.**

By Lieut. Col. Gillespie, 1887, for improvement of Winthrop Harbor by conversion of tidal depression into a channel 3,900 feet long, 50 feet wide, and 6 feet deep at mean low water, from the "Back Channel" to "Rices Wharf," at an estimated cost of \$17,600, '88, 470, 471; '89, 571; '92, 574.

**Surveys.**

Ordered by act of August 5, 1886. Made, 1887, under direction of Lieut. Col. Gillespie, '88, 470.

**MAPS.**

'88, 470.

**WINYAW BAY, S. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 562.)

**Appropriations.**

1886-'87 .....	\$18, 750
1888 .....	100, 000, '88, 931.
1890 .....	100, 000, '90, 1171.
1892 .....	100, 000, '92, 1191.

Total ..... 318, 750

**Commerce.**

Commerce of the bay, '88, 933.

Necessity of further improvement, '89, 1110.

**Contracts.**

1889. J. S. Howell, for diking, etc., at a total of \$96,555, '90, 1172.

1890. W. T. Gaynor, for sheet piling, stone, mattress, etc., at a total of \$192,640, '91, 1414.

## WINYAW BAY, S. C.—Continued.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 130; '89, 147, 1111, 1112; '90, 132; '91, 169; '92, 169.

**BOARD OF ENGINEERS.**

Convened at New York, December 24, 1888, by S. O. No. 51, to examine and report upon Capt. Bixby's plan for the improvement of Winyaw Bay. Report, '89, 1114. (Col. Comstock and Lieut. Cols. Houston and Robert.)

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1885-'92. Reports, '88, 929; '89, 1106; '90, 1169; '91, 1411.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1187.

**ASSISTANTS.**

R. Whitford. Reports, '88, 931; '89, 1109; '90, 1173; '91, 1414.

C. Humphreys. Reports, '91, 1415; '92, 1191.

**Operations.**

1887-'89. No operations for lack of funds, '88, 930; '89, 1108.

1889-'90. 1,017 tons riprap placed in jetty, '90, 1170.

1890-'91. 1,013 square yards of mattress, 460 cubic yards of shell, 2,325 tons small stone, and 685 tons of large stone used in jetty construction, '91, 1413.

1891-'92. 46,276 tons of stone, 141 cubic yards of oyster shells, 21,147 square yards of mattress, and 194,976 feet, B. M., of sheet piling used in jetty construction, '92, 1188.

**Projects.**

By Capt. Bixby, 1885, approved by Board of Engineers, 1888, to secure a permanent channel of entrance over the bar from 15 to 20 feet deep at mean low water by construction of two converging jetties, extending from South Island and the southern end of North Island, respectively, and running to the 18-foot curve of depth. These jetties to be built of riprap on brush mattress foundation, with a top width of from 10 to 20 feet and a height of 6 feet above mean low water; estimated cost, \$2,500,000, '89, 1114, 1115; '92, 1188.

**Surveys.****MAPS.**

'89, 1114; '90, 1172; '92, Atlas, 43, 44.

## WISCONSIN AND FOX RIVERS.—(See FOX AND WISCONSIN RIVERS.)

## WITHLACOOCHIEE RIVER, FLA.—IMPROVEMENT OF.

(Continued from Vol. II, p. 563.)

**Appropriations.**

1881-'87 .....	\$13,500
1888 .....	5,000, '88, 1116.
1890 .....	5,400, '90, 1608.

Total ..... 23,900

List of appropriations prior to 1888, '90, 1607.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 149; '89, 172; '90, 154; '91, 193; '92, 190.

**ENGINEERS IN CHARGE.**

Capt. W. M. Black, 1886-'92. Reports, '88, 1114; '89, 1345, 2797; '90, 1606; '91, 1659, 2797.

Maj. J. C. Mallery, 1892-'—. Report, '92, 1389.

**Obstructions.**

Bridge obstructing the river at Dunellon, '89, 2797.

**Operations.**

1887-'89. No operations for lack of funds, '88, 1115; '89, 1346.

1889-'90. 47 snags and trees removed from river bed, and 203 cubic yards rock blasted; 891 trees cut and trimmed on the banks, '90, 1607.

1890-'91. Removal of obstructions in progress, '91, 1659.

1891-'92. 79 snags and 10 overhanging trees removed; 465 cubic yards of rock blasted; 296 cubic yards of rock removed, and 128 linear feet of dam built, '92, 1390.

**WITHLACOOCHEE RIVER, FLA.—Continued.****Physical Characteristics.**

Description of the river, '89, 1345.

**Projects.**

By Maj. Damrell, 1880, for improvement of the river from its mouth to Hays Ferry, a distance of 100 miles, by removal of snags, overhanging trees, and loose rocks, and cutting through shoals and a bar at the mouth; estimated cost, \$23,874, '80, 1111.

In 1888 the project was modified to permit the extension of the improved channel to Pemberton Ferry, 6 miles from Hays Ferry, '92, 1390.

**WOODBRIIDGE CREEK, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 565.)

**Appropriations.**

1879-'82..... \$19,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 71.

ENGINEER IN CHARGE.

Capt. G. McC. Derby, 1886-'88. Report, '88, 650.

**Operations.**

1887-'88. No operations, '88, 650.

**Projects.**

By Col. Macomb, 1879, to widen the stream near Salamander Dock, dredging through shoal near Valentines Dock, and constructing a pile revetment for the purpose of straightening the banks in that vicinity to procure a uniform depth of 12 feet at mean high water; width of channel to be 80 feet from mouth to Salamander Dock; estimated cost, \$13,800, '79, 67, 478, 479, 480; '86, 781. Estimate revised in 1884 to \$29,000, '84, 750; '86, 782; '87, 770.

**WOODBURY CREEK, N. J.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 565.)

**Appropriations.**

1882..... \$5,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 83.

ENGINEER IN CHARGE.

Lieut. Col. H. M. Robert, 1885-'88. Report, '88, 710.

**Operations.**

1887-'88. Operations suspended until available funds will permit the formation of the proposed channel in a single season, '88, 710.

**Projects.**

By Lieut. Col. Weitzel, 1883, for improvement of the creek by excavation of a channel of navigable width and 8 feet depth at high stage of water, from the Delaware River to Broad Street Bridge, in the town of Woodbury; estimated cost, \$15,000, '83, 642.

**WOODS HOLL HARBOR, MASS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 566.)

**Appropriations.**

1852-'87..... \$109,000

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 34.

ENGINEER IN CHARGE.

Maj. W. R. Livermore, 1887-'88. Report, '88, 488.

**WOODS HOLL HARBOR, MASS.—Continued.****Operations.**

1887-'88. Improvement completed as far as contemplated, '88, 488.

**Projects.**

The appropriation of \$15,000, made in 1879, was expended in dredging and removing bowlders from the entrance to the harbor, '80, 369; '81, 545.

The project of 1882 proposed the construction of retaining walls on shore, a hollow pier and wharves for the use of the Fish Commission and other branches of the public service, and removal of rocks from the straits; estimated cost, \$52,775, '82, 550, 551; '84, 598. Work under this project was completed July 20, 1887, '88, 488.

**WOOD RIVER, OREG.—EXAMINATION OF.**

(Continued from Vol. II, p. 566.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '88, 304.

ENGINEER IN CHARGE.

Capt. C. F. Powell, 1887-'88. Report, '88, 2177.

**Physical Characteristics.**

Description of the locality, '88, 2178.

**Plans.**

In 1887 Capt. Powell did not consider the river worthy of improvement, '88, 2177.

**Surveys.**

Examination ordered by act of August 5, 1886. Made, 1887, under direction of Capt. Powell, '88, 2177.

**WRECKS.—REMOVAL OF.**

[Abbreviations: Bg., brig; Bk., bark; Brg., barge; C. b., canal boat; Sc., scow; Sch., schooner; Sl., sloop; Sp. ship; S. a., steamship; Str., steamer.]

Locality.	Description.	References.
Algiers, La.....	Sp. Ile Marthe.....	'89, 201, 1500.
Ashtabula Harbor, Ohio.....	Sch. Joy.....	'89, 328, 2334; '90, 296, 2787.
Baltimore Harbor, Md.....	Sch. W. W. French.....	'89, 115, 942.
Barnegat Inlet, N. J.....	Str. Mediator.....	'91, 118, 1090.
Bayou Teche, La.....	Brg. ....	'92, 223, 1513.
Bogue Sound, N. C.....	Sch. Laura J.....	'89, 147, 1116.
Boston Harbor, Mass.....	Sch. Goldsmith Maid.....	} '89, 43, 562.
	Sch. Mary.....	
Broadkirk River, Del.....	Str. J. I. Van Dusen.....	'88, 95, 753.
Buzzards Bay, Mass.....	Sch. Annie E. Hayes.....	'89, 55, 641.
Cambridge Harbor, Md.....	Sch. Two Brothers.....	'89, 111, 905; '90, 101, 942.
Cape Cod, Mass.....	Sch. J. B. Woodbury.....	} '92, 66, 641.
	Sch. Bertha J. Fellows.....	
Charleston Bar, S. C.....	Wreckage.....	'90, 141, 1233.
Chehaw River, S. C.....	Str. Alice Clark.....	'88, 138, 990.
Chesapeake Bay, Md.....	Str. Express.....	} '88, 104, 775; '90, 942.
	Brg. Harry.....	
	Sch. J. W. Knight.....	
Choptank River, Md.....	Sl. Eva Hemingway.....	'89, 111, 905; '90, 101, 942.
Cobbs Island, Va.....	Sch. Ann R. Rogers.....	'92, 131, 980.
Columbia River, Oreg.....	Sp. Sylvia de Grasse.....	'91, 420, 3373.
Connecticut River, Conn.....	Sl. Sc. G. C. Bloomer.....	} '88, 57, 583.
	Sch. R. H. Daly.....	
Cuttyhunk Pond, Mass.....	Sch. Quilp.....	'90, 50, 584.
Darien Harbor, Ga.....	Str. Molton.....	} '92, 180, 1292, 1293.
	Str. St. Matthews.....	
Delaware Bay and River.....	Sch. Gen. W. T. Sherman.....	'91, 118, 1090.
	C. b. Agatha Brady.....	} '92, 119, 940.
	Str. Blanche Henderson.....	
	Brg. Casilda.....	
	Sch. David Lee.....	
	Sch. G. H. Bent.....	
	Bk. Il Salvatore.....	
	Bk. Patriot.....	
	Brg. St. Cloud.....	
	Sch. S. C. Morton.....	
	Brg. Tonawanda.....	} '88, 85, 716; '89, 101, 875; '90, 92, 905.
	Brg. Wallace.....	

## WRECKS.—REMOVAL OF—Continued.

Locality.	Description.	References.
Elizabethport, N. J.....	Brg. Nellie.....	'91, 107, 1013.
Hampton Roads Channel, Va.....	Bk. Pettingill.....	'89, 120, 963; '90, 806, 1026.
Handkerchief Light-ship, Conn.....	Sch. Benjamin Gartaide.....	'90, 50, 585; '91, 61, 731.
Harlem River, N. Y.....	C. b. —.....	'88, 67, 637.
Hempstead Harbor, N. Y.....	Str. Bay Ridge.....	'89, 70, 733; '90, 62, 667.
Hog Island, Va.....	Sch. Harvey W. Anderson.....	'92, 131, 980.
Hudson River, N. Y.....	Sl. Locomotive.....	'88, 67, 637.
Hyannis Harbor, Mass.....	Sch. S. S. Bickmore.....	'91, 62, 732.
Jackson Creek, Md.....	Sch. Maria Green.....	'91, 131, 1201.
Little Harbor, Mass.....	Sch. Ellen R.....	'90, 50, 584.
Long Island Sound.....	Sch. E. J. Higgins.....	'88, 57, 584.
Mattaponi River, Va.....	Sch. Louisa Bliss.....	
	Sl. —.....	
	Sc. —.....	'88, 116, 845.
	Sch. —.....	
Moosebeac Reach, Me.....	Sch. Huntress.....	'92, 39, 533.
Nantucket Light, Mass.....	Sch. Andrew J. York.....	
Nantucket Sound, Mass.....	Sch. Lucy Jones.....	'92, 65, 638.
	Sch. Allie Oakes.....	
	Sch. Edith T. Gandy.....	'92, 66, 640.
Newburyport Harbor, Mass.....	Sch. J. E. Sanford.....	'90, 87, 516.
New Orleans Harbor, La.....	Sp. He Marthe.....	'91, 231, 1869.
	Str. E. J. Gay.....	
New York Harbor, N. Y.....	C. b. —.....	'92, 97, 838.
	Sch. F. E. Hallock.....	'91, 93, 937.
	Str. Atlas.....	
	Bk. Quickstep.....	'88, 67, 637; '89, 82, 789.
	C. b. —.....	
	C. b. —.....	
Norfolk Harbor, Va.....	Brg. Marion.....	'88, 104, 774.
Ogeechee River, Ga.....	Tug Columbus.....	'91, 1605.
	Str. Nashville.....	
Pamlico River, N. C.....	Sch. —.....	'92, 169, 1194.
	Sch. —.....	'91, 169, 1417.
Pamunkey River, Va.....	Brg. Amicus.....	'89, 134, 1025; '90, 121, 1064.
Pasquotank River, N. C.....	Sch. Dorcas and Eliza.....	'88, 104, 775.
Pensacola River, Fla.....	Sp. Bride of Lorne.....	
	Bk. Laigia.....	'88, 158, 1189; '89, 184, 1402.
	Wreckage.....	
Pleasant River, Me.....	Schs. Golden Eagle and Cerullus.....	'91, 32, 610.
Point Celeste, Mississippi River, La.....	Dry dock.....	'92, 224, 1521.
Pollock Rip Shoal, Cape Cod, Mass.....	Sch. S. L. Simmons.....	'90, 50, 583.
	Sch. Weybasset.....	'92, 65, 637; '91, 61, 731.
	Sch. Python.....	'92, 66, 640.
	Sch. Florence Nowell.....	'92, 66, 641.
Port Clinton Harbor, Ohio.....	Tug Wilcox.....	'92, 352, 2510.
	Sl. Rescue.....	
Portland Harbor, Me.....	Sch. Annie J. Russell.....	'91, 32, 609.
Provincetown Harbor, Mass.....	Sch. A. A. Halton.....	'90, 37, 516.
Rancocas River, N. J.....	Sc. Paddy Ryan.....	'92, 119, 940.
Rappahannock River, Va.....	Sch. Spray.....	'88, 116, 845.
Raritan Bay, N. J.....	C. b. —.....	'92, 97, 839.
	Sch. Salamander.....	'91, 83, 937.
Rhode Island Harbor, R. I.....	Sch. Josiah Whitehouse.....	'91, 61, 732.
Rockland Harbor, Me.....	Sch. Isabel Alberts.....	'92, 39, 533.
St. Clair River, Mich.....	Sch. M. E. Tremble.....	'91, 261, 2891.
	Sch. Hannah Moore.....	'92, 344, 2463.
Savannah Harbor, Ga.....	Str. Habersham.....	
	Str. Milledgeville.....	'91, 184, 1602.
	Str. General Lee.....	
St. Johns River, Fla.....	Str. Maple Leaf.....	
	Bg. Neva.....	'89, 151, 1122; '89, 174, 1352.
	Brg. —.....	
Ship Island Harbor, Miss.....	Bk. Bruce.....	'91, 229, 1837; '92, 223, 1513.
Smyrna River, Del.....	Sch. Mary H. Rhoads.....	'91, 131, 1201.
South Channel, Charleston, S. C.....	Bk. Red Earl.....	'91, 178, 1487.
Townsend Inlet, N. J.....	Str. Nuphar.....	'92, 119, 940.
Vineyard Haven Harbor, Mass.....	Sch. Mary E. Oliver.....	'92, 65, 639.
	Sch. Alma.....	'89, 55, 640.

**YADKIN RIVER, N. C.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 569.)

**Appropriations.**

1879-'86 .....	\$87,000
1888.....	10,000, '88, 919.
1890.....	5,000, '90, 1164.
1892.....	5,000, '92, 1182.

Total ..... 107,000

List of appropriations, '92, 1182.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 127, 134; '89, 145; '90, 131; '91, 167; '92, 168.

**ENGINEERS IN CHARGE.**

Capt. W. H. Bixby, 1886-'92. Reports, '88, 917; '89, 1099; '90, 1161; '91, 1404.

Maj. W. S. Stanton, 1892-'—. Report, '92, 1181.

**ASSISTANTS.**

Frank Brown. Reports, '90, 1164; '91, 1406.

Lieut. H. Taylor. Report, '88, 954.

**Operations.**

1887-'88. 510 cubic yards rock removed from river channel, and 1,321 cubic yards rock built into 2,489 linear feet of training wall, '88, 918.

1888-'89. 910 cubic yards stone quarried, and 1,740 linear feet of wing dam and training wall built, '89, 1100.

1889-'90. 225 cubic yards stone removed from the channel, and 600 linear feet wing dam and training wall built, '90, 1162.

1890-'91. 197 linear feet of dam work and 73 linear feet of training wall built, '91, 1407.

1891-'92. 392 linear feet of dams built, and 216 cubic yards of rock removed from the channel, '92, 1182.

**Physical Characteristics.**

Description of river from South Carolina to the Narrows, N. C., '88, 955, 953.

**Plans.**

Capt. Bixby, 1888, did not consider the river, from South Carolina to the Narrows, N. C., as worthy of improvement, '88, 952.

**Projects.**

The original project of S. T. Abert, 1879, proposed to secure a 2.5 to 3 foot navigation during the entire year over the 64½ miles above the Salisbury Railroad Bridge, to be accomplished by dredging and rock removal, at an estimated final cost of \$400,000, '87, 133, 1063.

In 1889, after an aggregate appropriation of \$97,000, the project was modified to secure only a cleared channel way of 60 feet available width and 2.5 to 3 feet clear depth for eight months of the year, from Salisbury Railroad Bridge, 35 miles, up to Baileys Ferry, at a further cost of \$10,000, '89, 1101; '92, 1182.

**Surveys.**

Examination of the river from South Carolina to the Narrows, N. C., ordered by act of August 5, 1886. Made, 1888, under direction of Capt. Bixby, '88, 952.

**MAPS.**

'90, 1164; '91, 1406; '92, Atlas, 39, 40.

**YALLABUSHA RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 569.)

**Appropriations.**

1881-'87 .....	\$11,000
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**Engineers.****ENGINEER IN CHARGE.**

Capt. J. H. Willard, 1888. Report, '88, 1362.

**Operations.**

1887-'88. No operations, '88, 1362.

**Projects.**

By Maj. Benyaurd, 1879, for improvement of the river from Grenada to its mouth, a distance of 63 miles, by removal of snags, sunken logs, leaning timber, etc.; estimated cost, \$7,000, '80, 1350; '87, 1473.

Additional expenditures required to maintain improvement, '87, 1473.

**YAMHILL RIVER, OREG.—SURVEY OF.**

(Continued from Vol. II, p. 570.)

**Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 421.

ENGINEER IN CHARGE.

Maj. T. H. Handbury, 1890. Report, '91, 3381, 3382.

**Physical Characteristics.**

Description of the locality, '91, 3381.

**Plans.**

By Maj. Handbury, 1891, for removal of logs, snags, and similar obstructions, at an estimated cost of \$3,000, '91, 3383.

**Surveys.**

Survey ordered by act of September 19, 1890. Made, 1891, under direction of Maj. Handbury, '91, 3382.

**YAQUINA BAY, OREG.—IMPROVEMENT OF ENTRANCE TO.**

(Continued from Vol. II, p. 570.)

**Appropriations.**

1880-'87 .....	\$235, 000
1888.....	150, 000, '88, 2149.
1890.....	165, 000, '90, 2970.
1892.....	85, 000, '92, 2694.

Total ..... 635, 000

List of appropriations, '92, 2695.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 299; '89, 355; '90, 320; '91, 403; '92, 378.

BOARD OF ENGINEERS.

Convened at Portland, Oreg., November 13, 1888, by S. O. No. 58, to examine and report upon project for improvement of entrance to Yaquina Bay. Report, '89, 2517. (Col. Mendell, and Majs. Jones and Handbury.)

ENGINEERS IN CHARGE.

Capt. W. Young, 1888-'90. Reports, '88, 2146; '89, 2513.

Capt. T. W. Symons, 1890-'—. Reports, '90, 2967, 2974; '91, 3182; '92, 2694.

ASSISTANTS.

J. S. Polhemus. Reports, '88, 2147; '89, 2514; '90, 2970.

G. A. Lyell. Report, '91, 3190.

Lieut. G. D. Fitch. Report, '92, 2698.

**Operations.**

1887-'88. Jetty extended 460 feet, '88, 2147.

1888-'89. Repairs to plant and main jetty tramway; 132 linear feet of wharf built and equipped with twisting apparatus; 2,100 linear feet of track laid; 3,300 tons of rock quarried; south jetty extended 4,265 feet, and 2,110 linear feet of tramway built for north jetty, '89, 2516.

1889-'90. 820 linear feet of tramway built for north jetty, and 12,980 tons of stone placed; 18,040 tons stone placed on south jetty, '90, 2969.

1890-'91. Preparation and repair of plant; north jetty extended 600 linear feet; 30,327 tons of stone placed upon old and new work; 2,080 feet of south jetty tramway built, '91, 3184, 3185.

1891-'92. North jetty extended 840 feet, and large part of south jetty completed; repairs and construction of plant, '92, 2697.

**Physical Characteristics.**

Description of the locality, '89, 2518.

**Projects.**

By Maj. Gillespie, 1880, for construction of a high-tide brush mattress and stone jetty about 4,000 feet long on the south side of the entrance to Yaquina Bay, to close a rock-obstructed channel, and to provide a central free channel of increased depth; depth to be obtained was placed, in 1881, at 17 feet, and subsequently raised to 19 feet, at mean high tide; estimated cost, \$465,000, '81, 329; '82, 2680; '87, 2465.

In 1886, \$235,000 having been appropriated for the work, Capt. Powell proposed the construction of a north jetty, which, with the further extension of the south jetty, was estimated to cost \$308,970 additional to the amount already appropriated, '86, 2001; '87, 237, 2465.

**YAQUINA BAY, OREG.—Continued.****Projects—Continued.**

By Capt. Young, 1888, for construction of a north mid-tide jetty of rubble stone extending from the north head along and behind the reef for a distance of about 2,300 feet; also to raise the south jetty to full high water, leaving an entrance width between the jetties of about 1,000 feet; estimated cost, \$196,750; approved by Board of Engineers, 1889, '89, 2519–2521.

In 1890 \$145,000 was estimated as required for completion of project, '90, 2770.

**YAZOO RIVER, MISS.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 571.)

**Appropriations.**

1873-'87 .....	\$158, 000
1888 .....	32, 000, '88, 1360.
1890 .....	25, 000, '91, 1999.
1892 .....	20, 000, '92, 1643.

Total ..... 235, 000

List of appropriations, '88, 1360.

**Engineers.**

CHIEF OF ENGINEERS.

Reports, '88, 181; '89, 213; '90, 191; '91, 243; '92, 235.

ENGINEER IN CHARGE.

Capt. J. H. Willard, 1886-'—. Reports, '88, 1359; '89, 1609; '90, 1892; '91, 1996; '92, 1624.

**Operations.**

1887-'88. 415 snags and stumps removed from the channel; 203 trees and shore snags removed from the banks, and 150 linear feet of wing dam built, '88, 1359.

1888-'89. Extensive repairs to snag boat *Meigs*; 494 snags removed from the channel, and 1,675 trees and shore snags removed from the banks, '89, 1610.

1889-'90. 730 logs and snags and 6 wrecks removed from the channel, and 94 shore snags and trees cleared from the banks, '90, 1893.

1890-'91. 403 snags and 10 log jams removed from the channel, and 633 leaning trees cleared from the banks, '91, 1997.

1891-'92. 750 snags, 55 shore snags, and 2 wrecks removed, '92, 1626.

**Projects.**

By Capt. Benyaud, 1874, for improvement of the river by construction of snag boat and removal of wrecks, snags, logs, and similar obstructions, '74, i, 365.

From 1873 to 1886 \$158,000 was appropriated, '87, 1470.

**Surveys.**

Survey from the Louisville, New Orleans and Texas Railroad Bridge to its mouth ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Willard, '91, 1998; '92, 1626.

MAPS.

'91, 1997.

**YELLOWBANKS, WIS.—(See CHIPPEWA RIVER.)****YELLOW RIVER, GA.—EXAMINATION OF.****Engineers.**

CHIEF OF ENGINEERS.

Report, '91, 184.

ENGINEER IN CHARGE.

Capt. O. M. Carter, 1891. Report, '91, 1606.

ASSISTANT.

Lieut. T. H. Rees. Report, '91, 1608.

**Physical Characteristics.**

Description of the locality, '91, 1606.



**YELLOW RIVER, GA.—Continued.****Plans.**

In 1891 Capt. Carter did not consider that the proposed improvement would develop any commerce commensurate with the outlay required, '91, 1607.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1891, under direction of Capt. Carter, '91, 1606.

**MAPS.**

'91, 1610.

**YELLOWSTONE RIVER, DAK. AND MONT.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 572.)

**Appropriations.**

1879-'87 ..... \$118,750

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 206; '89, 240; '90, 215; '91, 276, 277; '92, 264.

**ENGINEERS IN CHARGE.**

Maj. C. J. Allen, 1888-'90. Reports, '88, 1559; '89, 1809.

Maj. W. A. Jones, 1890-'91. Report, '90, 2098.

Capt. C. F. Powell, 1891-'—. Reports, '91, 2236, 2239; '92, 1903.

**Operations.**

1887-'92. No operations, '88, 1559; '89, 1809; '90, 2098; '91, 2236; '92, 1903.

**Plans.**

By Capt. Powell, 1891, for improvement of the river below Glendive, giving a 3-foot low-water channel by the construction of closing dams, revetment, and dredging; estimated cost, \$281,250, '91, 2241.

In 1891 Col. Poe did not consider the improvement of any portion of the Yellowstone River warranted by existing needs of commerce, '91, 2242.

**Projects.**

By Lieut. Maguire, 1878, for improvement of the river by removal of rocks, snags, trees, and similar obstructions, and construction of wing dams and shore protection for the unification of the channel; cost indeterminate, '79, 1098.

From 1879 to 1886, inclusive, \$118,750 was appropriated; estimated cost to complete project in 1887, \$106,000, '87, 1603; '88, 1559.

**Surveys.**

Examination from its mouth to the mouth of the Tongue River. Made, 1891, under direction of Capt. Powell, '91, 2239.

**YORK HARBOR, ME.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 573.)

**Appropriations.**

1886-'87 ..... \$15,000  
 1888 ..... 10,000, '88, 394.  
 1890 ..... 10,000, '91, 603.  
 1892 ..... 9,000, '92, 527.

Total ..... 44,000

**Contracts.**

1889. T. Symonds, for dredging, at 50 cents, and rock removal, at \$10 per cubic yard. '89, 539.

1891. T. Symonds, for rock removal, at \$13 per cubic yard, '91, 603.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 19; '89, 28; '90, 23; '91, 29; '92, 35.

**ENGINEERS IN CHARGE.**

Lieut. Col. J. A. Smith, 1885-'92. Reports, '88, 393; '89, 537; '90, 450; '91, 602.

Lieut. Col. P. C. Hains, 1892-'—. Report, '92, 526.

**Operations.**

1887-'88. 19,342 cubic yards gravel and rock removed, '88, 393.

1888-'89. No operations, '89, 537.

**YORK HARBOR, ME.—Continued.****Operations—Continued.**

1889-'90. 1,210 cubic yards sand, gravel, and bowlders and 214 cubic yards solid rock removed, '90, 450.  
 1890-'91. 760 cubic yards rock removed, '91, 602.  
 1891-'92. No operations, '92, 526.

**Projects.**

By Col. Blunt, 1885, for improvement of York Harbor by dredging at obstructed points in the existing channel to obtain a uniform depth of 10 feet at low water; estimated cost, \$25,000, '85, 487. Increased \$5,000 in 1887 by Lieut. Col. Smith, '87, 462. Revised in 1888, by Lieut. Col. Smith, to cost \$44,000, '88, 393; '92, 526.

**YORK RIVER, VA.—IMPROVEMENT OF.**

(Continued from Vol. II, p. 573.)

**Appropriations.**

1880-'87 .....	\$98,750
1888.....	30,000, '88, 832.
1890.....	30,000, '90, 1077.
1892.....	35,000, '92, 1058.

Total ..... 193,750

List of appropriations, '88, 830.

**Contracts.**

1888. American Dredging Company, for dredging, at 12 cents per cubic yard, '89, 1015.

1891. Baltimore Dredging Company, for dredging and depositing material in dike, at 14½ cents per cubic yard; contract amended for dredging alone, at 9 cents per cubic yard, '91, 1271.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '88, 113; '89, 131; '90, 118; '91, 143; '92, 144.

**ENGINEERS IN CHARGE.**

S. T. Abert, U. S. agent, 1888-'91. Reports, '88, 830; '89, 1015; '90, 1076.

Lieut. Col. P. C. Hains, 1891-'92. Report, '91, 1270.

Maj. C. E. L. B. Davis, 1892-'— . Report, '92, 1056.

**Operations.**

1887-'88. No operations for lack of funds, '88, 831.

1888-'89. 223,500 cubic yards material dredged, '89, 1016.

1889-'90. No operations, '90, 1076.

1890-'91. Dredging in progress, '91, 1271.

1891-'92. 166,130 cubic yards material dredged, '92, 1058.

**Projects.**

By Capt. Phillips, 1880, for improvement of the river from West Point to the mouth by excavation of a channel 400 feet wide and 22 feet deep at low water, with the formation of a basin in front of the wharves; estimated cost, \$256,000, '80, 777; '85, 984; '87, 946.

Modified in 1887 by the addition of a dike extending from the bank opposite West Point, increasing the total estimate to \$309,750, '87, 946; '92, 1057.

**YOUNGS BAY CHANNEL, OREG.—EXAMINATION OF.****Engineers.****CHIEF OF ENGINEERS.**

Report, '91, 420, 3376.

**ENGINEER IN CHARGE.**

Maj. T. H. Handbury, 1891. Report, '91, 3376.

**Physical Characteristics.**

Description of the locality, '91, 3377.

**Plans.**

In 1890 Maj. Handbury did not consider the locality worthy of improvement, '91, 3377.

**Surveys.**

Examination ordered by act of September 19, 1890. Made, 1890, under direction of Maj. Handbury, '91, 3377.

**YOUNGS AND KLASKUINE RIVERS, OREG.—SURVEY OF.****Appropriations.**

1890..... \$1,600, '91, 3372.

**Engineers.****CHIEF OF ENGINEERS.**

Reports, '89, 358; '90, 324; '91, 419; '92, 393.

**ENGINEERS IN CHARGE.**

Capt. W. Young, 1889. Report, '90, 2989, 2991.

Maj. T. H. Handbury, 1891. Reports, '91, 3371; '92, 2839.

**ASSISTANT.**

J. S. Polhemus. Report, '90, 2992.

**Operations.**

1890-'91. 61 snags and logs cleared from the channel, '91, 3372.

1891-'92. No operations, '92, 2839.

**Physical Characteristics.**

Description of the locality, '90, 2992.

**Plans.**

By Capt. Young, 1889, for removal of snags, logs, and similar obstructions from Youngs and Klaskanine rivers; estimated cost, \$1,650, '90, 2993.

**Surveys.**

Survey ordered by act of August 11, 1888. Made, 1889, under direction of Capt. Young, '90, 2992.

# TOPICAL INDEX

OF

## ENGINEERING AND PHYSICAL DATA, ETC.,

COMPILED FROM THE

### REPORTS OF THE CHIEF OF ENGINEERS, U. S. ARMY,

1888-1892, INCLUSIVE.

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## SUMMARY OF APPROPRIATIONS for Rivers and Harbors from the earliest date, April 6, 1802, to and including the act of July 13, 1892.

PLAN.—The States are arranged in alphabetical order, and under each State are placed the appropriations for the works lying wholly within that State, these works being also arranged alphabetically. All the appropriations for the improvement of any portion of a river, except a harbor, are assigned to that river, and if the river passes through or by more than one State the river is placed under the head of "Miscellaneous," which immediately follows the States. Thus, appropriations for the Muscle Shoals would not be found under Alabama, but would be included in those for the Tennessee River, which would be found under "Miscellaneous;" appropriations for an ice harbor at St. Louis would be under the State of Missouri, but appropriations for the Mississippi River at St. Louis, or for the mouth of the Mississippi River, would be included in those for the Mississippi River. Explanatory notes are placed at the end of the table, which are referred to by numerals in parenthesis.

The same locality is sometimes referred to in the acts making appropriations therefor under different titles, or a local improvement has become merged in one more general. For such cases the most usual or comprehensive title has been adopted in this table.

[NOTE.—The details of the appropriations and references to authorities for each sum will be generally found under the proper title of the work in Vols. I, II, and III of the Index.

The lists of appropriations in the main Index were generally compiled from the reports of the Chief of Engineers, beginning with 1866. The following table was compiled directly from the acts of Congress making appropriations for rivers and harbors, and subsequent to the completion of the main part of Vol. II of the Index, consequently in a few cases appropriations appear in this table which are not found in the lists of appropriations in the main work. These exceptions mainly apply to improvements completed before 1866, and for which no appropriations were subsequently made. In the earlier reports of the Chief of Engineers allotments from appropriations for "repair, preservation, contingencies, and surveys" are sometimes referred to as though they were specific appropriations for the works to which they were assigned. In the following table such allotments, except as subsequently noted, are not included in the aggregate of separate works. For these reasons, in a few cases, the total amount appropriated, as stated in the main Index, will be found to differ for the same work from the total stated in this table.

By the acts of June 23, 1864, July 25, 1868, and April 10, 1869, \$250,000, \$1,500,000, and \$2,000,000 were, respectively, appropriated for repair and extension, and allotted to works specified in the statements attached to these acts in the compilation of "Laws of the United States relating to the improvement of rivers and harbors." The amounts therein allotted are assigned in the following table to the works named. (See note 24.)

Between 1826 and 1874, inclusive, the sum of \$181,606.27 was reapportioned; these reapportionments are not included in the following table. The following appropriations have also been omitted: Transportation, fuel, etc., acts of August 30, 1852, and May 15, 1856 (aggregating \$12,127.12); allotments from indefinite appropriations for "removal of wrecks, etc.," as provided for by act of June 14, 1880.] (See note 25.)

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Alabama:</b>					
Alabama River.....	1878	\$255,000.00	.....	\$255,000.00	
Black Warrior River (?). ....	1844	224,250.00	.....	224,250.00	
Cahaba River.....	1882	45,000.00	.....	45,000.00	
Mobile Harbor.....	1826	2,192,330.00	.....	2,192,330.00	
Panx Au Heron.....	1823	18,000.00	.....	18,000.00	
Tallapoosa River.....	1882	44,000.00	.....	44,000.00	
					\$2,778,580.00
<b>Arkansas:</b>					
Catche River.....	1888	9,000.00	.....	9,000.00	
Fouche la Pave River.....	1879	33,500.00	.....	33,500.00	
L'Anguille River.....	1878	17,000.00	.....	17,000.00	
Little Missouri River.....	1871	20,000.00	.....	20,000.00	
Little Red River.....	1886	8,400.00	.....	8,400.00	
Petit Jean River.....	1886	9,500.00	.....	9,500.00	
Saline River.....	1880	21,500.00	.....	21,500.00	
White River.....	1874	296,000.00	.....	296,000.00	
White and St. Francis rivers (?).....	1833	144,000.00	1,500	145,500.00	
White, Black, and Little Red rivers (?).....	1871	10,000.00	.....	10,000.00	
					570,400.00
					503

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>California:</b>					
Feather River. (See Sacramento and Feather rivers.)					
Humboldt Harbor	1881	\$572,500.00		\$572,500.00	
Mokelumne River	1884	15,500.00		15,500.00	
Napa River	1888	17,500.00		17,500.00	
Oakland Harbor	1874	1,684,600.00		1,684,600.00	
Petaluma Creek	1880	46,000.00		46,000.00	
Red Wood Harbor	1884	23,400.00		23,400.00	
Sacramento and Feather rivers	1875	645,000.00		645,000.00	
San Diego Harbor	1852	222,500.00	\$5,000	227,500.00	
San Francisco Harbor and Bay (*)	1808	165,927.27		165,927.27	
San Joaquin River	1876	323,750.00		323,750.00	
San Luis Obispo	1888	95,000.00		95,000.00	
San Pedro and Santa Monica bays, harbor of refuge	1890		15,000	15,000.00	
Wilmington Harbor	1871	995,000.00		995,000.00	
					\$4,826,677.27
<b>Connecticut:</b>					
Black Rock Harbor	1836	68,550.00		68,550.00	
Bridgeport Harbor	1836	280,000.00		280,000.00	
Cedar Point Beach	1836	1,000.00		1,000.00	
Clinton Harbor	1882	8,500.00		8,500.00	
Connecticut River (*)	1820	527,231.57	130	527,361.57	
Coe Cob Creek	1892	7,000.00		7,000.00	
Duck Island Harbor	1890	60,000.00		60,000.00	
Five Mile River Harbor	1888	15,000.00		15,000.00	
Housatonic River	1871	163,500.00		163,500.00	
Milford Harbor	1874	45,500.00		45,500.00	
Mill River	1829	10,587.43		10,587.43	
Mystic River	1890	20,000.00		20,000.00	
New Haven Harbor	1852	306,000.00		306,000.00	
New Haven Harbor Breakwater	1879	610,000.00		610,000.00	
New London Harbor	1880	17,300.00		17,300.00	
Norwalk Harbor	1829	108,000.00	80	108,080.00	
Saugatuck Harbor	1826	25,416.00		25,416.00	
Saybrook Bar. (See Connecticut River.)					
Southport Harbor	1836	21,000.00		21,000.00	
Stamford Harbor	1829	35,000.00	100	35,100.00	
Stonington Harbor	1827	327,253.83	200	327,453.83	
Thames River	1821	406,500.00	300	406,800.00	
Westport Harbor. (See Saugatuck Harbor.)					
Wilson Point Harbor	1890	30,000.00		30,000.00	
					3,092,148.83
<b>Delaware:</b>					
Appoquinimink River	1890	10,000.00		10,000.00	
Broad Creek	1880	30,000.00		30,000.00	
Broadkill River	1873	35,000.00		35,000.00	
Chincooteague and Delaware bays	1886	143,750.00		143,750.00	
Christiana River. (See Wilmington Harbor.)					
Delaware Bay, ice harbor	1882	25,000.00		25,000.00	
Delaware Breakwater	1822	2,677,353.70	1,000	2,678,353.70	
Delaware Breakwater Harbor, removal of wrecks	1880	25,000.00		25,000.00	
Delaware River, ice harbor at Reedy Island	1852	51,000.00		51,000.00	
Duck Creek. (See Smyrna River.)					
Indian River	1882	10,000.00		10,000.00	
Lewes, pier at	1870	378,500.00		378,500.00	
Mispillion Creek	1879	29,000.00		29,000.00	
Murderkill River	1892	7,000.00		7,000.00	
Nanticoke River	1886	10,000.00		10,000.00	
New Castle Harbor	1826	239,173.00		239,173.00	
St. Jones River	1881	40,000.00		40,000.00	
Smyrna River	1880	28,000.00		28,000.00	
Wilmington Harbor	1836	359,606.00		359,606.00	
					4,099,472.70
<b>District of Columbia:</b>					
Washington and Georgetown harbors (*)	1833	2,495,000.00	1,500	2,496,500.00	
					2,496,500.00

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Florida:</b>					
Appalachicola Bay and River .....	1828	\$201,850.29	\$500	\$201,850.29	
Bayou La Grange .....	1886	8,000.00		8,000.00	
Caloosahatchee River .....	1882	28,000.00		28,000.00	
Cedar Keys Harbor .....	1872	104,500.00		104,500.00	
Charlotte Harbor. (See Pease Creek.)					
Chipola River .....	1835	9,000.00		9,000.00	
Clearwater Harbor. (See Cedar Keys.)					
Holmes River. (See Bayou La Grange.)					
Indian River .....	1892	15,000.00		15,000.00	
Indian River and Mosquito Lagoon.	1844	6,500.00		6,500.00	
Key West Harbor .....	1882	167,500.00		167,500.00	
Manatee River .....	1882	42,000.00		42,000.00	
Ocklawaha River .....	1835	46,000.00		46,000.00	
Ocklockonee River .....	1833	5,000.00		5,000.00	
Pease Creek .....	1881	51,000.00		51,000.00	
Pensacola Harbor .....	1878	350,000.00		350,000.00	
St. Augustine Creek .....	1879	5,000.00		5,000.00	
St. Augustine Harbor .....	1829	98,269.80	300	98,569.80	
St. Johns River (*) .....	1852	1,226,500.00		1,226,500.00	
St. Johns River (Upper) .....	1844	4,000.00		4,000.00	
St. Marks River .....	1828	37,030.00	500	37,530.00	
Sarasota Bay .....	1890	7,500.00		7,500.00	
Suwannee River .....	1839	59,000.00		59,000.00	
Tampa Bay .....	1880	130,000.00		130,000.00	
Volusia Bar .....	1840	27,000.00		27,000.00	
Withlacoochee River .....	1881	23,900.00		23,900.00	
Yellow River .....	1839		500	500.00	
					\$2,653,850.09
<b>Georgia:</b>					
Altamaha River .....	1881	95,000.00		95,000.00	
Brunswick Harbor .....	1836	137,500.00		137,500.00	
Cocoawatee River. (See Ooste- nauia River.)					
Darien Harbor .....	1878	58,000.00		58,000.00	
Etowah River .....	1878	10,000.00		10,000.00	
Flint River (?) .....	1878	172,000.00		172,000.00	
Jekyll Creek .....	1888	20,000.00		20,000.00	
Ocmulgee River (?) .....	1878	134,500.00		134,500.00	
Oconee River .....	1878	95,000.00		95,000.00	
Oostenaula and Cocoawatties rivers.	1874	26,000.00		26,000.00	
Romely Marsh .....	1882	42,108.77		42,108.77	
Savannah River and Harbor (?) .....	1826	2,713,356.64	10,000	2,723,356.64	
					2,518,465.41
<b>Idaho:</b>					
Clearwater River .....	1879	15,000.00		15,000.00	
Snake River .....	1892	20,000.00		20,000.00	
					35,000.00
<b>Illinois:</b>					
Calumet Harbor .....	1870	447,400.00		447,400.00	
Chicago Harbor .....	1833	2,176,005.00		2,176,005.00	
Galena River and Harbor .....	1878	66,000.00		66,000.00	
Hennepin and Illinois and Michigan canals.	1882		45,000	45,000.00	
Illinois River .....	1852	1,868,650.00		1,868,650.00	
Illinois and Mississippi Canal .....	1890	1,000,000.00		1,000,000.00	
Kaskaskia River .....	1890	10,500.00		10,500.00	
Waukegan Harbor .....	1852	190,000.00		190,000.00	
					5,801,555.00
<b>Indiana:</b>					
Michigan City Harbor .....	1836	1,161,138.92		1,161,138.92	
White River .....	1879	112,500.00		112,500.00	
					1,273,638.92
<b>Iowa:</b>					
Des Moines and Iowa rivers .....	1838		1,000	1,000.00	
Dubuque Ice Harbor .....	1844	69,500.00		69,500.00	
Red Cedar River .....	1839		1,500	1,500.00	
					72,000.00
<b>Kentucky:</b>					
Barren River. (See Grand River.)					
Cumberland River (South Fork) .....	1882	12,000.00		12,000.00	
Green River and tributaries .....	1888	185,000.00		185,000.00	

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Kentucky—Continued.</b>					
Kentucky River (*)	1879	\$1,651,495.74		\$1,651,495.74	
Licking River.	1888	6,000.00		6,000.00	
Muddy River. (See Green River.)					
Rough River.	1890	40,000.00		40,000.00	
Tradewater River.	1881	16,500.00		16,500.00	
					\$1,910,995.74
<b>Louisiana:</b>					
Amite River and Bayou Manchac.	1880	26,300.00		26,300.00	
Bayou Black.	1881	25,000.00		25,000.00	
Bayou Boeuf.	1881	41,000.00		41,000.00	
Bayou Chitto (Bogue)	1890	10,000.00		10,000.00	
Bayou Courtableau.	1880	31,200.00		31,200.00	
Bayou D'Arbonne.	1884	15,000.00		15,000.00	
Bayou La Fourche.	1852	180,000.00	\$2,500	182,500.00	
Bayou Loggy.	1884	10,000.00		10,000.00	
Bayou Manchac. (See Amite River.)					
Bayou Maçon. (See Tensas River.)					
Bayou Pierre.	1884	5,000.00	8,600	13,600.00	
Bayou Plaquemine.	1888	350,000.00		350,000.00	
Bayous Roundaway and Vidal.	1888	2,000.00		2,000.00	
Bayou Teche.	1870	55,000.00	700	55,700.00	
Bayou Teche, canal from.	1881	25,000.00		25,000.00	
Bayou Terrebonne.	1880	38,800.00		38,800.00	
Bayou Vidal. (See Bayou Round- away.)					
Bayou Vermillion.	1892	7,500.00		7,500.00	
Calcasieu Pass and River.	1872	241,500.00		241,500.00	
Cane River.	1884	2,500.00		2,500.00	
Lake Pontchartrain Canal.	1809		25,000	25,000.00	
Lake Pontchartrain Harbor.	1852	25,000.00		25,000.00	
Little River.	1888	2,500.00		2,500.00	
Mormonteau River.	1892	7,500.00		7,500.00	
Tangipahoa River.	1872	11,500.00		11,500.00	
Tchefuncte River.	1872	13,500.00		13,500.00	
Tensas River and Bayou Maçon.	1881	26,000.00		26,000.00	
Tockfaw River.	1881	9,000.00		9,000.00	
Tones Bayou. (See Red River, Ark., La., and Tex.)					
Vermillion River.	1890	9,900.00		9,900.00	
					1,207,500.00
<b>Maine:</b>					
Bangor Harbor and Penobscot River	1829	348,000.00	300	348,300.00	
Bar Harbor.	1888	150,000.00		150,000.00	
Bath. (See Kennebec River.)					
Bagaduce River.	1888	12,000.00		12,000.00	
Belfast Bay and Harbor.	1828	51,266.00		51,266.00	
Camden Harbor.	1873	53,000.00		53,000.00	
Cathance River.	1880	21,000.00		21,000.00	
Cobscook Bay.	1836	5,000.00	300	5,300.00	
Harrisack River.	1890	26,000.00		26,000.00	
Jonesport. (See Mooseabec River.)					
Kennebec River.	1827	431,945.71		431,945.71	
Kennebunk River.	1829	85,175.00		85,175.00	
Lubec Channel.	1880	125,000.00		125,000.00	
Machias River.	1873	32,000.00		32,000.00	
Matinicus Island Breakwater.	1852		1,000	1,000.00	
Mooseabec River and Bar.	1881	85,000.00		85,000.00	
Narragausus River.	1871	57,000.00		57,000.00	
Owls Head Harbor.	1836	17,502.11	400	17,902.11	
Penobscot River. (See Bangor Harbor.)					
Piscataqua River.	1826	8,510.00	200	8,510.00	
Pleasant River.	1890	3,500.00		3,500.00	
Portland Harbor.	1836	672,727.05		672,727.05	
Richmond Harbor.	1881	20,000.00		20,000.00	
Richmond Island.	1852	120,000.00		120,000.00	
Rockland Harbor.	1880	220,000.00		220,000.00	
Rockport Harbor.	1888	15,000.00		15,000.00	
Royal River.	1871	30,000.00		30,000.00	
Saco River and Harbor.	1827	331,775.00		331,775.00	
St. Croix River.	1867	74,000.00		74,000.00	
Sullivan River.	1871	35,000.00		35,000.00	
Union River.	1870	30,000.00		30,000.00	
Wells Harbor.	1872	5,000.00		5,000.00	
York Harbor.	1886	44,000.00		44,000.00	
					3,111,400.87

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Maryland:</b>					
Annapolis Harbor.....	1880	\$10,000.00	-----	\$10,000.00	
Baltimore Harbor.....	1836	3,299,030.00	-----	3,299,030.00	
Battery Island (Chesapeake Bay).....	1846	17,275.00	-----	17,275.00	
Bretton Bay (Leonardtown Harbor).....	1878	37,500.00	-----	37,500.00	
Cambridge Harbor.....	1871	50,237.00	-----	50,237.00	
Chesapeake Bay.....	1836	-----	\$500	500.00	
Chester River.....	1876	49,000.00	-----	49,000.00	
Choptank River.....	1880	48,000.00	-----	48,000.00	
Coraica Creek.....	1882	30,000.00	-----	30,000.00	
Crisfield Harbor.....	1875	37,317.50	-----	37,317.50	
Deals Island.....	1881	10,000.00	-----	10,000.00	
Elk River.....	1874	46,500.00	-----	46,500.00	
Fairlee Creek.....	1888	10,000.00	-----	10,000.00	
Kent Narrows. (See Chester River.).....					
La Trappe River.....	1892	2,500.00	-----	2,500.00	
Manokin River.....	1890	15,000.00	-----	15,000.00	
North East River.....	1872	20,640.00	-----	20,640.00	
Patapsco River. (See Baltimore Harbor.).....					
Patuxent River.....	1888	11,000.00	-----	11,000.00	
Pocomoke River.....	1878	20,500.00	-----	20,500.00	
Queenstown Harbor.....	1871	14,000.00	-----	14,000.00	
St. Jeromes Creek.....	1881	26,500.00	-----	26,500.00	
Secretary Creek.....	1880	6,000.00	-----	6,000.00	
Susquehanna River.....	1852	166,390.00	-----	166,390.00	
Treadhaven Creek.....	1880	6,000.00	-----	6,000.00	
Warwick River.....	1892	6,000.00	-----	6,000.00	
Wicomico River.....	1872	66,500.00	-----	66,500.00	
Worton Harbor.....	1872	12,000.00	-----	12,000.00	
					\$4,018,389.00
<b>Massachusetts:</b>					
Ilas River.....	1829	20,000.41	150	20,150.41	
Boston Harbor.....	1825	2,754,196.10	-----	2,754,196.10	
Canapisset Channel.....	1892	4,800.00	-----	4,800.00	
Chatham Harbor.....	1890	5,000.00	-----	5,000.00	
Duxbury Harbor.....	1836	25,000.00	-----	25,000.00	
East Dennis Breakwater.....	1852	-----	1,500	1,500.00	
Edgarton Harbor.....	1826	22,500.00	500	23,000.00	
Essex River.....	1890	5,000.00	-----	5,000.00	
Fall River Harbor.....	1874	30,000.00	-----	30,000.00	
Gloucester Harbor.....	1823	86,000.00	-----	86,000.00	
Kingham Harbor.....	1886	19,000.00	-----	19,000.00	
Hyannis Harbor.....	1827	157,431.82	-----	157,431.82	
Ipswich Harbor.....	1886	7,500.00	-----	7,500.00	
Lynn Harbor.....	1882	101,000.00	-----	101,000.00	
Malden River.....	1882	10,000.00	-----	10,000.00	
Manchester Harbor.....	1888	14,300.00	-----	14,300.00	
Marblehead Harbor.....	1825	500.00	400	900.00	
Marthas Vineyard Harbor.....	1890	4,500.00	-----	4,500.00	
Merrimac River.....	1828	242,366.72	-----	242,366.72	
Mystic and Malden rivers.....	1892	10,000.00	-----	10,000.00	
Nantucket Harbor.....	1828	240,534.75	300	240,834.75	
New Bedford Harbor.....	1836	65,191.87	-----	65,191.87	
Newburyport Harbor.....	1880	277,500.00	-----	277,500.00	
Plymouth Harbor.....	1824	195,566.90	-----	195,566.90	
Powow River.....	1888	12,000.00	-----	12,000.00	
Provincetown Harbor.....	1826	188,328.44	-----	188,328.44	
Rockport. (See Sandy Bay.).....					
Salem River.....	1873	53,000.00	-----	53,000.00	
Sandy Bay, harbor of refuge.....	1829	669,232.57	-----	669,232.57	
Scituate Harbor.....	1829	72,500.00	1,180	73,680.00	
Taunton River.....	1852	171,000.00	3,000	174,000.00	
Vineyard Haven Harbor.....	1888	42,500.00	-----	42,500.00	
Wareham Harbor.....	1872	96,236.00	-----	96,236.00	
Wellfleet Harbor.....	1872	16,000.00	-----	16,000.00	
Westport Harbor.....	1886	3,000.00	-----	3,000.00	
Weymouth Harbor.....	1890	20,000.00	-----	20,000.00	
Winthrop Harbor.....	1888	9,000.00	-----	9,000.00	
Woods Holl Harbor.....	1852	109,000.00	-----	109,000.00	
					5,766,715.08
<b>Michigan:</b>					
Alpena Harbor.....	1876	45,000.00	-----	45,000.00	
Aux Sable River and Harbor.....	1867	113,970.00	-----	113,970.00	
Aux Becs Seles. (See Frankfort Harbor.).....					

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Michigan—Continued.</b>					
Belle River.....	1881	\$14,000.00	.....	\$14,000.00	
Benton Harbor. (See St. Josephs River.).....					
Black Lake (Holland) Harbor.....	1852	279,615.31	.....	279,615.31	
Black River.....	1848	65,000.00	.....	65,000.00	
Cedar River Harbor.....	1862	50,000.00	.....	50,000.00	
Charlevoix Harbor.....	1876	112,500.00	.....	112,500.00	
Cheboygan Harbor.....	1871	148,000.00	.....	148,000.00	
Clinton River.....	1852	60,064.00	.....	60,064.00	
Eagle Harbor.....	1866	97,000.00	.....	97,000.00	
Frankfort Harbor.....	1866	284,659.85	.....	284,659.85	
Grand Haven Harbor.....	1852	713,866.15	.....	713,866.15	
Grand Marais Harbor.....	1880	261,250.00	.....	261,250.00	
Grand River.....	1881	50,000.00	.....	50,000.00	
Grosse Point.....	1888	5,000.00	.....	5,000.00	
Harbor of Refuge, Lake Huron. (See Sand Beach, Mich.).....					
La Plaisance Bay.....	1826	19,603.07	\$200	19,803.07	
Ludington Harbor.....	1867	357,435.00	.....	357,435.00	
Manistee Harbor.....	1867	348,000.00	.....	348,000.00	
Manistique Harbor.....	1830	6,000.00	.....	6,000.00	
Marquette Harbor.....	1867	474,230.00	.....	474,230.00	
Monroe Harbor.....	1835	235,515.27	.....	235,515.27	
Muskegon Harbor.....	1867	404,000.00	.....	404,000.00	
New Buffalo Harbor.....	1852	83,000.00	.....	83,000.00	
Ontonagon Harbor.....	1867	328,100.00	.....	328,100.00	
Pontwater Harbor.....	1807	238,820.00	.....	238,820.00	
Petoskey Harbor.....	1890	35,000.00	.....	35,000.00	
Portage Lake Harbor.....	1879	100,500.00	.....	100,500.00	
Portage Lake Ship Canal.....	1888	420,000.00	10,000	430,000.00	
Rouge River.....	1888	36,690.00	.....	36,690.00	
Saginaw River.....	1866	668,750.00	.....	668,750.00	
St. Clair Flats Canal (?).....	1852	863,894.40	.....	863,894.40	
St. Josephs Harbor.....	1836	427,113.00	.....	427,113.00	
St. Josephs River.....	1848	3,500.00	.....	3,500.00	
St. Marys River and Falls Canal (10).....	1856	7,352,900.22	.....	7,352,900.22	
Sand Beach, Lake Huron.....	1871	1,310,000.00	.....	1,310,000.00	
Saugatuck Harbor.....	1868	145,439.00	.....	145,439.00	
Schewaling Harbor.....	1875	15,000.00	.....	15,000.00	
South Haven Harbor.....	1867	217,000.00	.....	217,000.00	
Thunder Bay. (See Alpena Har- bor.).....					
White River Harbor.....	1867	279,550.00	.....	279,550.00	
<b>Minnesota:</b>					\$16,650,165.27
Agate Bay.....	1886	92,500.00	.....	92,500.00	
Burlington Bay. (See Agate Bay.).....					
Duluth Harbor.....	1871	741,250.00	.....	741,250.00	
Grand Marais Harbor.....	1879	127,350.00	.....	127,350.00	
Lake City. (See Miscellaneous, Lake Pepin.).....					
Minnesota Point.....	1890	4,895.00	.....	4,895.00	
Minnesota River.....	1867	127,500.00	.....	127,500.00	
<b>Mississippi:</b>					1,063,495.00
Big Black River.....	1894	15,000.00	.....	15,000.00	
Big Sunflower River.....	1879	62,000.00	.....	62,000.00	
Biloxi Harbor and Bay.....	1882	45,000.00	.....	45,000.00	
Bluff Creek.....	1890	1,000.00	.....	1,000.00	
Chickasaw River.....	1890	10,000.00	.....	10,000.00	
Coldwater River.....	1879	11,000.00	.....	11,000.00	
East Pascagoula River.....	1852	.....	5,000	5,000.00	
Horn Island Pass.....	1884	5,000.00	.....	5,000.00	
Leaf River.....	1890	10,000.00	.....	10,000.00	
Noxubee River.....	1880	56,000.00	.....	56,000.00	
Old Town Creek.....	1882	3,000.00	.....	3,000.00	
Pascagoula River.....	1827	171,500.00	.....	171,500.00	
Pearl River.....	1879	187,625.00	.....	187,625.00	
Steels Bayou.....	1884	12,500.00	.....	12,500.00	
Tallahatchee River.....	1879	42,500.00	.....	42,500.00	
Tchula Lake.....	1881	18,000.00	.....	18,000.00	
Yalabusha River.....	1881	11,000.00	.....	11,000.00	
Yazoo River.....	1873	235,000.00	.....	235,000.00	
					901,125.00

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Missouri:</b>					
Cuivre River.....	1880	\$12,000.00	.....	\$12,000.00	
Gasconade River.....	1880	50,500.00	.....	50,500.00	
Little River.....	1888	8,000.00	.....	8,000.00	
St. Louis Harbor.....	1880	182,000.00	.....	182,000.00	
St. Louis Ice Harbor.....	1836	164,600.00	.....	164,600.00	
					\$417,100.00
<b>New Hampshire:</b>					
Bellamy River.....	1888	27,500.00	.....	27,500.00	
Cocheco River.....	1836	210,000.00	.....	210,000.00	
Exeter River.....	1880	35,000.00	.....	35,000.00	
Lake Winnepiseogee.....	1880	7,500.00	.....	7,500.00	
Lamprey River.....	1886	20,000.00	.....	20,000.00	
Little Harbor.....	1886	100,000.00	.....	100,000.00	
Portsmouth Harbor.....	1879	137,000.00	.....	137,000.00	
					537,000.00
<b>New Jersey:</b>					
Alloway Creek.....	1880	9,000.00	.....	9,000.00	
Arthur Kill.....	1888	22,000.00	.....	22,000.00	
Atlantic City Harbor.....	1886	.....	\$5,000	5,000.00	
Cheesquakes Creek.....	1880	40,000.00	.....	40,000.00	
Cohansey Creek.....	1873	36,000.00	.....	36,000.00	
Cranberry Inlet.....	1852	.....	1,000	1,000.00	
Elizabeth River.....	1879	37,000.00	.....	37,000.00	
Flat Beach.....	1829	.....	100	100.00	
Goshen Creek.....	1880	3,000.00	.....	3,000.00	
Keyport Harbor.....	1882	35,475.00	.....	35,475.00	
Little Egg Harbor.....	1836	23,500.00	.....	23,500.00	
Manasquan River.....	1879	41,000.00	.....	41,000.00	
Mantua Creek.....	1882	3,000.00	.....	3,000.00	
Mattawan Creek.....	1881	33,120.00	.....	33,120.00	
Maurice River.....	1882	43,000.00	.....	43,000.00	
Newark Bay.....	1852	10,000.00	2,000	12,000.00	
Passaic River.....	1872	423,350.00	.....	423,350.00	
Raccoon River.....	1882	3,000.00	.....	3,000.00	
Rahway River.....	1879	37,000.00	.....	37,000.00	
Rancocas River.....	1881	35,000.00	.....	35,000.00	
Raritan Bay.....	1881	262,500.00	.....	262,500.00	
Raritan River.....	1836	625,213.00	.....	625,213.00	
Salem River.....	1871	17,000.00	.....	17,000.00	
Shrewsbury River.....	1852	233,000.00	1,500	234,500.00	
South River.....	1871	98,000.00	.....	98,000.00	
Woodbridge Creek.....	1879	19,000.00	.....	19,000.00	
Woodbury Creek.....	1882	5,000.00	.....	5,000.00	
					2,103,758.00
<b>New York:</b>					
Black River.....	1836	42,401.00	.....	42,401.00	
Black Rock Harbor.....	1829	52,098.00	.....	52,098.00	
Browns Creek (Sayville).....	1890	17,000.00	.....	17,000.00	
Buffalo Harbor.....	1828	2,752,955.37	.....	2,752,955.37	
Buttermilk Channel.....	1880	446,250.00	.....	446,250.00	
Canarsie Bay.....	1880	53,000.00	.....	53,000.00	
Cattaraugus Creek.....	1836	57,410.00	.....	57,410.00	
Charlotte Harbor.....	1828	494,028.40	300	494,328.40	
Dunkirk Harbor.....	1827	531,579.38	.....	531,579.38	
East Chester Creek.....	1873	69,000.00	.....	69,000.00	
East River and Hell Gate.....	1852	4,280,700.00	.....	4,280,700.00	
Echo Harbor.....	1878	22,000.00	.....	22,000.00	
Flushing Bay.....	1879	115,000.00	.....	115,000.00	
Glen Cove Harbor.....	1888	45,000.00	.....	45,000.00	
Gowanus Bay.....	1881	491,100.00	.....	491,100.00	
Grass River.....	1882	9,000.00	.....	9,000.00	
Great Chazy River.....	1890	15,000.00	.....	15,000.00	
Greenport Harbor.....	1882	46,000.00	.....	46,000.00	
Harlem River.....	1874	905,000.00	.....	905,000.00	
Hudson River.....	1834	1,886,038.00	.....	1,886,038.00	
Hudson River (opposite Jersey City).....	1875	25,000.00	.....	25,000.00	
Huntington Harbor.....	1872	37,500.00	.....	37,500.00	
Jamaica Bay.....	1892	9,460.00	.....	9,460.00	
Larchmont Harbor.....	1890	5,000.00	.....	5,000.00	
Mamaroneck Harbor.....	1882	15,000.00	.....	15,000.00	
New Rochelle Harbor.....	1881	35,000.00	.....	35,000.00	
Newtown Creek and Bay.....	1880	177,500.00	.....	177,500.00	
New York Harbor (Gedneys Chan- nel).....	1884	1,853,070.00	.....	1,853,070.00	



**APPROPRIATIONS for Rivers and Harbors, etc.—Continued.**

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<i>New York—Continued.</i>					
New York Harbor, Sandy Hook <sup>(1)</sup> .....	1868	\$116,530.00	.....	\$116,530.00	
Niagara River at Tonawanda Creek.....	1881	126,500.00	.....	126,500.00	
Niagara River from Tonawanda to Port Day.....	1892	20,000.00	.....	20,000.00	
Oak Orchard Harbor.....	1836	205,000.00	.....	205,000.00	
Ogdensburg Harbor.....	1852	239,005.56	\$3,000	242,005.56	
Olcott Harbor.....	1867	163,000.00	.....	163,000.00	
Oswego Harbor.....	1826	1,799,412.87	600	1,800,012.87	
Patchogue River.....	1890	23,000.00	.....	23,000.00	
Peconic River.....	1871	25,000.00	.....	25,000.00	
Plattsburg Harbor.....	1836	185,680.01	.....	185,680.01	
Port Chester Harbor.....	1872	42,000.00	.....	42,000.00	
Port Day. (See Niagara River.).....					
Port Jefferson Harbor.....	1852	114,000.00	1,200	115,200.00	
Portland Harbor.....	1836	56,616.00	.....	56,616.00	
Port Ontario Harbor.....	1836	50,000.00	.....	50,000.00	
Pultneyville Harbor.....	1870	74,000.00	.....	74,000.00	
Rondout Harbor.....	1872	110,500.00	.....	110,500.00	
Rouses Point Harbor.....	1884	98,500.00	.....	98,500.00	
Sacketts Harbor.....	1826	15,000.00	.....	15,000.00	
Sag Harbor.....	1829	.....	150	150.00	
St. Lawrence River.....	1890	15,000.00	.....	15,000.00	
Sandy Creek.....	1828	.....	303	300.00	
Saugerties Harbor.....	1884	47,000.00	.....	47,000.00	
Sheepshead Bay.....	1880	26,000.00	.....	26,000.00	
Shoal Harbor and Comptons Creek.....	1890	8,000.00	.....	8,000.00	
Sodus Harbor (Great).....	1829	452,646.80	.....	452,646.80	
Sodus Harbor (Little).....	1852	316,941.77	.....	316,941.77	
Staten Island Ice Breaker.....	1836	19,500.00	.....	19,500.00	
Sumpawanus Inlet.....	1881	7,000.00	.....	7,000.00	
Ticonderoga River.....	1881	16,500.00	.....	16,500.00	
Tonawanda Creek. (See Niagara River.).....					
Waddington Harbor.....	1873	35,500.00	.....	35,500.00	
Wappingers Creek.....	1890	13,000.00	.....	13,000.00	
Whitehall Harbor.....	1836	33,000.00	.....	33,000.00	
Wilson Harbor.....	1875	65,000.00	.....	65,000.00	
					\$19,012,513.16
<i>North Carolina:</i>					
Beaufort Harbor.....	1836	160,000.00	.....	160,000.00	
Beaufort Harbor and New River.....	1837	85,000.00	.....	85,000.00	
Black River.....	1886	13,000.00	.....	13,000.00	
Cape Fear River.....	1829	2,956,478.92	.....	2,956,478.92	
Cape Fear and Waccamaw rivers.....	1888	15,000.00	.....	15,000.00	
Coanjob Bay. (See Currituck Sound.).....					
Contentnea Creek.....	1881	59,000.00	.....	59,000.00	
Croatan Sound.....	1843	50,000.00	15,000	65,000.00	
Currituck Sound.....	1878	161,500.00	.....	161,500.00	
Currituck Sound and North River Bar.....	1878	142,500.00	.....	142,500.00	
Edenton Bay.....	1878	17,000.00	.....	17,000.00	
Fishing Creek.....	1890	15,000.00	.....	15,000.00	
Lillington River.....	1881	6,000.00	.....	6,000.00	
Lockwoods Folly.....	1890	8,000.00	.....	8,000.00	
Lumber River.....	1888	15,000.00	.....	15,000.00	
Mackays Creek.....	1890	15,000.00	.....	15,000.00	
Meherrin River.....	1882	5,000.00	.....	5,000.00	
Neuse River.....	1878	287,500.00	.....	287,500.00	
New Berne to Beaufort.....	1882	25,000.00	.....	25,000.00	
Newport River. (See New Berne to Beaufort.).....					
New River.....	1882	38,000.00	.....	38,000.00	
New River to Swansboro, inland Waterway.....	1890	5,000.00	.....	5,000.00	
North East River.....	1890	10,000.00	.....	10,000.00	
North River Bar. (See Currituck Sound.).....					
Ocracoke Inlet.....	1826	237,750.00	1,000	238,750.00	
Pamlico and Tar rivers.....	1836	98,000.00	.....	98,000.00	
Pequotank River.....	1829	6,000.00	80	6,080.00	
Perquimans River.....	1876	2,500.00	.....	2,500.00	
Roanoke River.....	1871	188,000.00	.....	188,000.00	
Scuppernon River.....	1878	8,000.00	.....	8,000.00	

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>North Carolina—Continued.</b>					
Tar River. (See Pamlico and Tar rivers.)					
Town Creek.....	1881	\$1,000.00	.....	\$1,000.00	
Trent River.....	1879	60,500.00	.....	60,500.00	
Washington Harbor.....	1852	5,000.00	.....	5,000.00	
Wilmington. (See Cape Fear River.)					
Yadkin River.....	1879	107,000.00	.....	107,000.00	
					\$4,818,808.92
<b>Ohio:</b>					
Ashtabula Harbor.....	1828	538,168.22	.....	538,168.22	
Black River Harbor.....	1879	252,204.77	.....	252,204.77	
Cincinnati Ice Harbor.....	1878	94,250.00	.....	94,250.00	
Cleveland Harbor.....	1825	1,622,994.84	.....	1,622,994.84	
Conneaut Harbor.....	1829	152,629.39	.....	152,629.39	
Cunningham Creek.....	1826	19,781.12	.....	19,781.12	
Fairport Harbor.....	1825	355,873.53	.....	355,873.53	
Grand River Harbor. (See Fairport Harbor.)					
Huron Harbor.....	1828	154,273.71	.....	154,273.71	
Maumee River.....	1872	7,000.00	.....	7,000.00	
Muskingum River, locks and dams.	1886	122,000.00	.....	122,000.00	
Muskingum River, ice harbor.....	1879	327,500.00	.....	327,500.00	
Port Clinton Harbor.....	1872	76,000.00	.....	76,000.00	
Rocky River Harbor.....	1872	39,000.00	.....	39,000.00	
Sandusky City Harbor.....	1826	406,792.00	\$400	407,192.00	
Sandusky River.....	1867	58,000.00	.....	58,000.00	
Toledo Harbor.....	1866	1,402,200.00	.....	1,402,200.00	
Vermillion Harbor.....	1836	128,701.28	.....	128,701.28	
					5,757,768.86
<b>Oregon:</b>					
Columbia River.....	1878	2,085,000.00	30,000	2,125,000.00	
Columbia River (Cascades).....	1876	2,203,750.00	.....	2,203,750.00	
Columbia River (Upper).....	1872	125,000.00	.....	125,000.00	
Columbia and Willamette rivers.....	1876	1,030,365.00	5,000	1,035,365.00	
Columbia and Snake rivers.....	1876	146,000.00	.....	146,000.00	
Coos Bay.....	1879	548,750.00	.....	548,750.00	
Coquille River.....	1880	130,000.00	.....	130,000.00	
Coquille River (Upper).....	1892	5,000.00	.....	5,000.00	
Nehalem Bay.....	1890	10,000.00	.....	10,000.00	
Siuslaw River.....	1890	70,000.00	.....	70,000.00	
Tillamook Bay.....	1888	20,700.00	.....	20,700.00	
Umpqua River.....	1871	33,501.47	.....	33,501.47	
Willamette River (Upper).....	1871	225,500.00	.....	225,500.00	
Yamhill River. (See Willamette River, Upper.)					
Yaquina River.....	1880	635,000.00	.....	635,000.00	
Youngs and Klaskanine rivers.....	1890	1,600.00	.....	1,600.00	
					7,315,166.47
<b>Pennsylvania:</b>					
Allegheny River.....	1879	352,500.00	.....	352,500.00	
Chester Creek.....	1881	6,000.00	.....	6,000.00	
Chester Harbor.....	1826	32,483.40	100	32,483.40	
Erie Harbor and Presque Isle.....	1823	931,717.23	150	931,867.23	
Frankford Creek.....	1882	10,000.00	.....	10,000.00	
Harris Island Dam. (See Allegheny River.)					
Marcus Hook Harbor.....	1829	219,000.00	.....	219,000.00	
Ridley Creek. (See Chester Creek.)					
Schuylkill River.....	1870	485,000.00	.....	485,000.00	
Susquehanna River.....	1890	45,000.00	.....	45,000.00	
					2,081,850.63
<b>Rhode Island:</b>					
Newport Harbor.....	1873	158,000.00	.....	158,000.00	
Block Island Harbor.....	1870	399,000.00	.....	399,000.00	
Church Cove Harbor.....	1827	28,200.00	200	28,200.00	
Coasters Harbor.....	1890	5,500.00	.....	5,500.00	
Greenwich Bay.....	1890	2,000.00	.....	2,000.00	
Pawtucket River.....	1867	232,000.00	.....	232,000.00	
Point Judith Breakwater.....	1890	150,000.00	.....	150,000.00	
Point Judith Pond.....	1892	.....	7,500	7,500.00	
Potowomut River.....	1881	5,000.00	.....	5,000.00	

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<i>Rhode Island—Continued.</i>					
Providence River and Narragan- sett Bay.....	1852	\$763,250.00	-----	\$763,250.00	\$1,765,450.00
Warren River.....	1886	5,000.00	-----	5,000.00	
Wickford Harbor.....	1873	10,000.00	-----	10,000.00	
<i>South Carolina:</i>					
Ashepoo River.....	1872	1,300.00	-----	1,300.00	3,460,865.00
Ashley River.....	1880	5,500.00	-----	5,500.00	
Beaufort River.....	1890	25,000.00	-----	25,000.00	
Charleston Harbor.....	1852	2,577,200.00	-----	2,577,200.00	
Clarke Creek.....	1888	7,500.00	-----	7,500.00	
Congaree River.....	1886	25,000.00	-----	25,000.00	
Edisto River.....	1882	33,385.00	-----	33,385.00	
Georgetown Harbor.....	1886	44,500.00	\$4,000	48,500.00	
Mingo Creek.....	1888	13,000.00	-----	13,000.00	
Pee Dee River (Great).....	1880	89,500.00	-----	89,500.00	
Pee Dee River (Little).....	1888	15,000.00	-----	15,000.00	
Salkehatchie River.....	1882	18,000.00	-----	18,000.00	
Santee River.....	1881	159,750.00	-----	159,750.00	
Sullivan's Island. (See Charleston Harbor.)					
Town Creek.....	1870	7,500.00	-----	7,500.00	
Wappoo Cut.....	1881	53,000.00	-----	53,000.00	
Wateres River.....	1881	62,500.00	-----	62,500.00	
Winyaw Bay.....	1886	318,750.00	-----	318,750.00	
<i>Tennessee:</i>					
Big Hatchie River.....	1880	35,500.00	-----	35,500.00	263,000.00
Caney Fork River.....	1880	25,000.00	-----	25,000.00	
Clinch River.....	1880	39,000.00	-----	39,000.00	
Duck River.....	1880	13,000.00	-----	13,000.00	
Forked Deer River.....	1882	25,000.00	-----	25,000.00	
Hiwassee River.....	1876	36,500.00	-----	36,500.00	
Little Tennessee River.....	1882	5,000.00	-----	5,000.00	
Obeys River.....	1880	11,500.00	-----	11,500.00	
Obion River.....	1892	7,500.00	-----	7,500.00	
Red River.....	1881	5,000.00	-----	5,000.00	
<i>Texas:</i>					
Aransas Pass and Bay.....	1879	581,250.00	-----	581,250.00	8,012,250.00
Bayou Buffalo.....	1881	193,750.00	-----	193,750.00	
Bayou Cedar.....	1890	32,150.00	-----	32,150.00	
Blue Buck Bar. (See Sabine Pass.)					
Brazos River.....	1880	158,750.00	-----	158,750.00	
Brazos Santiago Harbor.....	1878	253,500.00	-----	253,500.00	
Colorado River.....	1852	20,000.00	-----	20,000.00	
Corpus Christi. (See Aransas Pass.)					
Fort Brown. (See Rio Grande River.)					
Galveston Bay.....	1872	656,700.00	10,000	666,700.00	
Galveston Bay, West.....	1892	15,000.00	-----	15,000.00	
Galveston Harbor.....	1870	3,828,000.00	-----	3,828,000.00	
Indianola Harbor. (See Matagor- da Bay.)					
Matagorda Bay.....	1876	327,500.00	-----	327,500.00	
Neches River.....	1878	33,000.00	-----	33,000.00	
Paso Cavallo. (See Matagorda Bay.)					
Red Fish Bar. (See Galveston Bay.)					
Rio Grande at Fort Brown.....	1876	18,000.00	-----	18,000.00	
Sabine Pass.....	1852	1,766,750.00	5,000	1,771,750.00	
Sabine River.....	1872	89,700.00	2,700	42,400.00	
San Antonio River.....	1852	-----	1,500	1,500.00	8,012,250.00
Trinity River.....	1852	67,000.00	2,000	70,000.00	
<i>Vermont:</i>					
Burlington Harbor.....	1836	581,922.20	-----	581,922.20	779,672.20
Gordons Landing.....	1886	34,750.00	-----	34,750.00	
Hero Islands Channel.....	1836	41,000.00	-----	41,000.00	
Otter Creek.....	1872	51,500.00	-----	51,500.00	
Swanton Harbor.....	1873	70,500.00	-----	70,500.00	

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			Total by States.
		For improve- ment.	For sur- vey.	Total.	
<b>Virginia:</b>					
Accotink Creek.....	1872	\$5,000.00		\$5,000.00	
Appomattox River.....	1871	423,830.00		423,830.00	
Aquia Creek.....	1872	25,500.00		25,500.00	
Archers Hope River.....	1881	10,000.00		10,000.00	
Blackwater River.....	1878	14,000.00		14,000.00	
Cape Charles City Harbor.....	1890	35,000.00		35,000.00	
Chickahominy River.....	1878	29,000.00		29,000.00	
Elizabeth River.....	1829	40,000.00	\$80	40,000.80	
Hampton River.....	1878	22,000.00		22,000.00	
James River.....	1836	1,552,500.00	500	1,553,000.00	
James and Appomattox rivers.....	1852	45,000.00		45,000.00	
Mattaponi River.....	1880	23,300.00		23,300.00	
Mathodoo River.....	1892	3,000.00		3,000.00	
Nansemond River.....	1873	67,000.00		67,000.00	
Neabeco Creek.....	1881	5,000.00		5,000.00	
Nomini Creek.....	1873	52,500.00		52,500.00	
Norfolk Harbor and approaches.....	1874	982,500.00		982,500.00	
Nottoway River.....	1880	7,000.00		7,000.00	
Ocoquan Creek.....	1873	40,000.00		40,000.00	
Onancock Harbor.....	1879	20,511.00		20,511.00	
Pagan Creek.....	1880	10,000.00		10,000.00	
Pamunkey River.....	1890	21,500.00		21,500.00	
Potomac River at Mount Vernon.....	1879	17,000.00		17,000.00	
Rappahannock River.....	1852	237,500.00	8,000	240,500.00	
Staunton River.....	1879	52,500.00		52,500.00	
Totusky River.....	1880	10,000.00		10,000.00	
Urbana Creek.....	1879	21,500.00		21,500.00	
York River.....	1880	193,750.00		193,750.00	
					\$3,989,971.00
<b>Washington:</b>					
Chehalis River.....	1882	13,000.00		13,000.00	
Cowlitz River.....	1880	22,000.00		22,000.00	
Grays Harbor and Bar.....	1892	50,000.00		50,000.00	
Naselle River.....	1892	1,500.00		1,500.00	
Olympia Harbor.....	1892	35,000.00		35,000.00	
Ship channel between Port Town- send Bay, Puget Sound, and Oak Bay.....	1892		15,000	15,000.00	
Ship canal connecting lakes Union, Washington, etc., with Puget Sound.....	1890		10,000	10,000.00	
Swinomish Slough.....	1892	25,000.00		25,000.00	
Willapa River and Harbor.....	1892	18,000.00		18,000.00	
					189,500.00
<b>West Virginia:</b>					
Buckhannon River.....	1884	5,500.00		5,500.00	
Cheat River.....	1890	13,000.00		13,000.00	
Elk River.....	1878	26,000.00		26,000.00	
Gauley River.....	1888	9,000.00		9,000.00	
Guyandotte River.....	1878	18,500.00		18,500.00	
Great Kanawha River (12).....	1873	2,895,337.00		2,895,337.00	
Little Kanawha River.....	1876	211,175.00		211,175.00	
					3,178,512.00
<b>Wisconsin:</b>					
Ahnapee Harbor.....	1871	173,000.00		173,000.00	
Ashland Harbor.....	1886	187,500.00		187,500.00	
Chippewa River.....	1876	141,750.00		141,750.00	
Fox and Wisconsin rivers (13).....	1839	8,568,497.10	2,000	8,568,497.10	
Green Bay Harbor.....	1866	322,550.00		322,550.00	
Kenosha Harbor.....	1884	260,307.41		260,307.41	
Kewaunee Harbor.....	1881	105,000.00		105,000.00	
Manitowoc Harbor.....	1852	335,820.00		335,820.00	
Milwaukee Bay.....	1881	570,000.00		570,000.00	
Milwaukee Harbor.....	1836	399,687.45	400	400,087.45	
Oconto Harbor.....	1881	71,000.00		71,000.00	
Pensaukee Harbor.....	1883	15,000.00		15,000.00	
Port Washington Harbor.....	1870	184,000.00		184,000.00	
Racine Harbor.....	1844	289,285.00		289,285.00	
Sheboygan Harbor.....	1852	343,448.91		343,448.91	
Stockholm. (See Miscellaneous, Lake Pepin.).....					
Sturgeon Bay Canal.....	1873	254,833.00		254,833.00	

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Wisconsin—Continued.</b>					
Superior Bay and St. Louis Bay....	1873	\$676,050.00	.....	\$676,050.00	
Two Rivers Harbor.....	1871	206,500.00	.....	206,500.00	
Wisconsin River. (See Fox and Wisconsin rivers.)					
					\$8,106,533.87
<b>Miscellaneous:</b>					
Arkansas River, improvement (Ark. and Kans.).....	1873	872,500.00	\$12,000	891,500.00	
Arkansas River, removal of snags..	1833	360,875.00	.....	360,875.00	
					1,252,375.00
Bayou Bartholomew (Ark. and La.)..	1881	38,000.00	.....	38,000.00	38,000.00
Big Sandy River (Ky. and W. Va.)..	1878	254,500.00	.....	254,500.00	254,500.00
Black River (Ark. and Mo.).....	1880	85,000.00	.....	85,000.00	85,000.00
Calumet River (Ill. and Ind.).....	1884	255,000.00	.....	255,000.00	255,000.00
Chattahoochee River (Ala. and Ga.)..	1835	220,000.00	.....	220,000.00	220,000.00
Chattahoochee and Flint rivers (Ala. and Ga.).....	1874	70,000.00	.....	70,000.00	70,000.00
Chesapeake and Delaware Bays Canal (Md. and Del.) (14).....	1874	.....	10,000	10,000.00	10,000.00
Chicago, Duluth, and Buffalo, ship channel between.....	1892	375,000.00	.....	375,000.00	375,000.00
Choctawhatchie River (Fla. and Ala.).....	1893	127,000.00	.....	127,000.00	127,000.00
Choctawhatchie and Holmes rivers (Fla. and Ala.).....	1844	10,000.00	.....	10,000.00	10,000.00
Colorado River (Cal., Nev., and Ariz.).....	1884	35,000.00	.....	35,000.00	35,000.00
Conecuh River. (See Escambia River, Ala. and Fla.).....					
Coosa River (Ga. and Ala.).....	1876	1,053,700.00	.....	1,053,700.00	1,053,700.00
Cumberland River (Ky. and Tenn.)..	1832	1,621,000.00	.....	1,621,000.00	1,621,000.00
Cumberland Sound (Ga. and Fla.)..	1880	762,500.00	.....	762,500.00	762,500.00
Current River (Mo. and Ark.).....	1872	7,000.00	.....	7,000.00	7,000.00
Cypress Bayou (La. and Tex.).....	1873	129,000.00	.....	129,000.00	129,000.00
Dan River (Va. and N. C.).....	1880	50,500.00	.....	50,500.00	50,500.00
Delaware River (Pa., N. J., and Del.).....	1802	2,312,000.00	.....	2,312,000.00	
Delaware River at Philadelphia (Pa. and N. J.).....	1886	1,041,000.00	5,000	1,046,000.00	
Delaware River, public piers.....	1802	34,961.71	.....	34,961.71	
					2,392,961.71
Dismal Swamp Canal (Va. and N. C.) (15).....	1826	175,000.00	10,000	185,000.00	185,000.00
Escambia and Conecuh rivers (Ala. and Fla.).....	1833	88,000.00	.....	88,000.00	88,000.00
Falls of Ohio River. (See Ohio River.)					
Falls of St. Anthony. (See Mississippi River.)					
French Broad River (Tenn. and N. C.).....	1876	96,000.00	.....	96,000.00	96,000.00
Harbor of Refuge, Pacific coast....	1877	150,000.00	.....	150,000.00	150,000.00
Harbor of Refuge, Gulf of Mexico..	1889	.....	2,000	2,000.00	2,000.00
Lake Champlain at Narrows (N. Y. and Vt.).....	1886	63,500.00	.....	63,500.00	63,500.00
Lake Pepin Harbor of Refuge (Minn. and Wis.).....	1882	60,000.00	.....	60,000.00	60,000.00
Louisville and Portland Canal. (See Ohio River.)					
Menomonee River and Harbor (Wis. and Mich.).....	1871	286,500.00	.....	286,500.00	286,500.00
<b>Mississippi River—</b>					
Reservoirs at sources.....	1879	789,500.00	25,000	814,500.00	
Above Falls of St. Anthony.....	1874	133,000.00	.....	133,000.00	
At Falls of St. Anthony.....	1870	615,000.00	.....	615,000.00	
At Meekers Island.....	1873	25,000.00	.....	25,000.00	
Minneapolis to mouth of Ohio River (16) (17).....	1852	9,959,100.00	.....	9,959,100.00	
At Des Moines Rapids (18).....	1856	5,345,450.00	.....	5,345,450.00	
At Rock Island Rapids.....	1866	1,166,650.00	.....	1,166,650.00	
Rock Island and Des Moines Rapids.....	1852	100,000.00	.....	100,000.00	

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Miscellaneous—Continued.</b>					
<b>Mississippi River—Continued.</b>					
From Ohio River to the Passes <sup>(15)</sup> .....	1874	\$19,837,000.00	\$25,000	\$19,862,000.00	
At its mouth <sup>(16)</sup> .....	1836	8,398,969.53	261,492	8,665,461.53	
Removal of snags, etc., from Upper.....	1870	507,000.00		507,000.00	
Removal of snags, etc., from Lower.....	1868	676,310.14		676,310.14	
From Passes to headwaters.....	1884		180,000	180,000.00	
Water gauges on.....	1876		56,800	56,800.00	
Mississippi River Commission, expenses of.....	1879		857,575	857,575.00	
					\$48,953,846.67
<b>Missouri River—</b>					
From mouth to Sioux City <sup>(17)</sup> ..	1876	4,951,500.00		4,951,500.00	
From Sioux City to Fort Ben- ton <sup>(18)</sup> .....	1876	475,000.00	15,000	490,000.00	
From Sioux City to Great Falls.....	1890	450,000.00		450,000.00	
From mouth to Fort Benton.....	1878	1,000,000.00	180,000	1,180,000.00	
Removal of snags, etc.....	1852	462,000.00		462,000.00	
In Montana.....	1892		2,500	2,500.00	
					7,536,000.00
<b>Monongahela River (Pa. and W. Va.) <sup>(19)</sup>.....</b>					
	1872	811,033.13		811,033.13	811,033.13
<b>Narragansett Bay, Little (R. I. and Conn.).....</b>					
	1876	36,000.00		36,000.00	36,000.00
<b>New River (Va. and W. Va.).....</b>					
	1876	112,000.00		112,000.00	112,000.00
<b>Norfolk Harbor to Albemarle Sound (Va. and N. C.).....</b>					
	1890	19,000.00		19,000.00	19,000.00
<b>North Landing River (Va. and N. C.).....</b>					
	1879	55,500.00		55,500.00	55,500.00
<b>Ohio River—</b>					
Except the Falls <sup>(21)</sup> .....	1835	5,701,914.25		5,701,914.25	
At the Falls <sup>(22)</sup> .....	1852	3,936,786.78	5,000	3,941,786.78	
Removal of snags, etc.....	1827	30,000.00		30,000.00	
					9,673,701.03
<b>Osage River (Mo. and Kans.).....</b>					
	1871	31,000.00		31,000.00	31,000.00
<b>Onachita and Black rivers (Ark. and La.).....</b>					
	1871	391,500.00		391,500.00	391,500.00
<b>Pawcatuok River (R. I. and Conn.).....</b>					
	1871	92,400.00		92,400.00	92,400.00
<b>Red River of the North (Minn. and Dak.).....</b>					
	1876	243,000.00		243,000.00	243,000.00
<b>Red River of the South (Ark., La., and Tex.).....</b>					
	1828	1,838,637.50	65,000	1,903,637.50	1,903,637.50
<b>Rock River (Ill. and Wis.).....</b>					
	1838		1,000	1,000.00	1,000.00
<b>St. Croix River (Minn. and Wis.).....</b>					
	1878	108,500.00		108,500.00	108,500.00
<b>St. Francis River (Ark. and Mo.).....</b>					
	1871	66,000.00		66,000.00	66,000.00
<b>St. Johns and St. Marys rivers (Fla. and Ga.).....</b>					
	1828	78,000.00		78,000.00	78,000.00
<b>St. Johns and St. Marys rivers canals to Gulf of Mexico.....</b>					
	1826		30,400	30,400.00	30,400.00
<b>Savannah and Fernandina, inside route between.....</b>					
	1892		15,000	15,000.00	15,000.00
<b>Savannah, Ocmulgee, Flint, and Chattahoochee rivers (Ga.).....</b>					
	1852		10,000	10,000.00	10,000.00
<b>Shenandoah River (Va. and W. Va.).....</b>					
	1880	17,500.00		17,500.00	17,500.00
<b>Staten Island channels (N. Y. and N. J.).....</b>					
	1874	114,000.00		114,000.00	114,000.00
<b>Tennessee River (Ky., Tenn., and Ala.).....</b>					
	1827	4,535,522.12	200	4,535,522.12	4,535,522.12
<b>Tombigbee and Warrior rivers (Ala. and Miss.).....</b>					
	1872	1,038,000.00		1,038,000.00	1,038,000.00
<b>Wabash River (Ind. and Ill.).....</b>					
	1828	754,500.00	500	755,000.00	755,000.00
<b>Waccamaw River (N. C. and S. C.).....</b>					
	1880	72,900.00		72,900.00	72,900.00
<b>White, Black, and St. Francis rivers (Ark. and Mo.).....</b>					
	1823		2,500	2,500.00	2,500.00
<b>Willamette and Yamhill rivers. (See Willamette, Upper.)</b>					
<b>Yellowstone River (Dak. and Mont.).....</b>					
	1879	118,750.00		118,750.00	118,750.00
<b>Western rivers, removing obstruc- tion from—</b>					
Construction of snag and dredge boats.....	1852	846,000.00		846,000.00	
Mississippi and Missouri rivers.....	1836	100,000.00		100,000.00	

## APPROPRIATIONS for Rivers and Harbors, etc.—Continued.

States and names of works.	Year of earliest appropriation.	Amounts appropriated.			
		For improve- ment.	For sur- vey.	Total.	Total by States.
<b>Miscellaneous—Continued.</b>					
Western rivers, etc.—Continued.					
Mississippi and Ohio rivers.....	1820	\$632,800.05	\$5,000	\$637,800.05	
Mississippi, Missouri, and Ar- kansas rivers.....	1870	1,400,000.00	.....	1,400,000.00	
Mississippi, Missouri, and Ohio rivers.....	1832	223,000.00	.....	223,000.00	
Mississippi, Missouri, Ohio, and Arkansas rivers.....	1842	980,000.00	.....	980,000.00	
					\$4,186,800.05
Northern and Northwestern Lakes—					
Construction of dredges for....	1836	122,682.96		122,682.96	
Survey of.....	1841		2,997,879	2,997,879.00	
Charts of.....	1849		144,000	144,000.00	
					3,264,561.96
Surveys, general—					
Works on Atlantic coast.....	1860		60,000	60,000.00	60,000.00
Works on Pacific coast.....	1866		50,000	50,000.00	50,000.00
Works on Northern and North- western lakes.....	1866		175,000	175,000.00	175,000.00
Western and Northwestern rivers.....	1819		286,000	286,000.00	286,000.00
Transportation routes.....	1874		230,000	230,000.00	230,000.00
Examinations, surveys, and con- tingencies <sup>(2)</sup> .....	1824		2,569,563	2,569,563.00	2,569,563.00
Repair and preservation of rivers and harbors <sup>(34)</sup> .....	1841	215,000.00		215,000.00	215,000.00
Grand totals <sup>(25)</sup> .....		227,658,463.06	8,574,009	236,232,472.06	236,232,472.06

## NOTES.

- <sup>1</sup> See also "Miscellaneous," Tombigbee and Warrior rivers.  
<sup>2</sup> See also "Miscellaneous," White, Black, and St. Francis rivers.  
<sup>3</sup> Includes \$154,927.27 for rock removal.  
<sup>4</sup> Includes \$23,471.57 for Saybrook Bar.  
<sup>5</sup> Includes Potomac River at Washington, D. C.  
<sup>6</sup> See also "Miscellaneous," St. Johns and St. Marys rivers.  
<sup>7</sup> See also Savannah, Ocmulgee, and Flint rivers.  
<sup>8</sup> Includes \$153,995.74 from the indefinite appropriation for care and operation of canals, etc.  
<sup>9</sup> Includes \$34,084.40 from the indefinite appropriation for care and operation of canals, etc.  
<sup>10</sup> Includes \$197,208.22 from the indefinite appropriation for care and operation of canals, etc.  
<sup>11</sup> Includes \$115,000 for removal of wreck of steamer *Scotland*.  
<sup>12</sup> Includes \$40,837 from indefinite appropriation for care and operation of canals, etc.  
<sup>13</sup> Includes \$113,817 for land damages, and \$176,550 from the indefinite appropriation for the care and operation of canals, etc.  
<sup>14</sup> The acts of March 3, 1825, and March 2, 1829, provided for the purchase of 2,250 shares of the Chesapeake and Delaware Canal.  
<sup>15</sup> The acts of May 13, 1826, and March 2, 1829, provided for the purchase of 800 shares of canal stock, and appropriated \$150,000 for completion of canal.  
<sup>16</sup> Includes appropriations for special points lying within these limits.  
<sup>17</sup> Includes \$43,000 for trial of Adams's flume.  
<sup>18</sup> Includes \$125,000 for construction of dry dock, and \$335,500 from indefinite appropriation for care and operation of canals, etc.  
<sup>19</sup> Includes \$5,525,000 paid to James B. Eads to June 30, 1888, for the improvement of South Pass.  
<sup>20</sup> Includes \$24,400 from the indefinite appropriation for care and operation of canals, etc.  
<sup>21</sup> Includes \$40,435 for Davis Island Lock and Dam, from the indefinite appropriation for care and operation of canals, etc.  
<sup>22</sup> Includes \$1,250,000 for purchase of the Louisville and Portland Canal as provided for in act of March 3, 1873, also \$426,657.91 from the indefinite appropriation for care and operation of canals, etc. The acts of May 13, 1826, and March 2, 1829, provided for the purchase by the United States of 2,350 shares of the canal stock.  
<sup>23</sup> Of this amount \$428,563 was appropriated between 1824 and 1846, for survey of canals, roads, etc., the balance between 1870 and 1888, inclusive, for examinations, surveys, and contingencies.  
<sup>24</sup> In addition to this amount the acts of June 28, 1864, July 25, 1868, and April 10, 1869, appropriated an aggregate of \$3,750,000 for the repair and extension of public works on rivers and harbors. This amount was allotted to various works, and is included in this table under the several works to which it was distributed.  
<sup>25</sup> These aggregates do not include the following: Reappropriations, \$181,606.27; transportation and fuel, \$2,127.12, and allotments from the indefinite appropriation for the removal of wrecks. The aggregates do include the sum of \$319,025.17 carried to the surplus fund.

ABSTRACT OF LAWS  
RELATING TO  
RIVER AND HARBOR IMPROVEMENTS  
AND  
OTHER PUBLIC WORKS OF THE UNITED STATES,  
FROM 1790 TO 1893.

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This abstract has been compiled from the following authorities, viz: "Laws of the United States relating to the improvement of rivers and harbors, from August 11, 1790, to March 3, 1887, compiled in the Office of the Chief of Engineers, United States Army, under the direction of John G. Parke, Colonel of Engineers, Brevet Major-General United States Army," and also from the "Laws affecting the Corps of Engineers, United States Army," as published in the annual reports of the Chief of Engineers, United States Army, since 1875.

For the interval between 1790 and 1875 the first-named publication was the authority from which the abstract was made; between 1885 and 1887 both publications have been used, while from 1887 to 1893, inclusive, the annual reports of the Chief of Engineers only have been used.

The abstract has been alphabetically arranged under the most suggestive headings, with cross references under secondary or minor headings. It is intended to cover the salient points only of the laws referred to, with the expectation that the acts of Congress themselves would be consulted for detailed and exact information.

The dates appended to each paragraph of the abstract are the dates of the laws from which the abstract is made.

This abstract is intended to cover only such legislation as has been general and permanent in its character, and not special or local legislation, or that which applied to temporary provisions in the river and harbor appropriation bills. In a few cases similar provisions have, from time to time, been repeated, and these have been incorporated in the abstract, but in all cases are marked thus: \*

**Appropriations.**

\* For river or harbor improvements, to remain subject to the disposal of the Secretary of War until the works for which the appropriations were made are completed, or until otherwise ordered by Congress.

July 23, 1866, section 3.

March 2, 1867, section 2.

June 20, 1874, section 5.

**Breakwaters.** (See also PUBLIC PROPERTY.)

Use, occupation, or injury of, by persons or corporations prohibited.

**Bridges.**

Any bridge over any navigable water of the United States which is an obstruction to free navigation by reason of difficulty in passing the draw or raft span shall be provided with aids to the passage of such spans.

July 5, 1884, section 8.

(See also March 3, 1875.)

Owners of bridge piers or abutments so built over navigable waters of the United States as to produce caving banks, or other damage to property, shall be liable to persons injured.

August 11, 1888, section 2.

Bridges obstructing navigation over navigable waterways of the United States shall be altered upon notice by the Secretary of War, so as to render navigation through or under bridges safe, easy, and unobstructed.

August 11, 1888, sections 9, 10.

Amended September 19, 1890, section 4.



**Bridges—Continued.**

No bridge, piers, or abutments to be built over or in any navigable waters prior to the approval of the location and plans of such bridge by the Secretary of War.

September 19, 1890, section 7.

Amended July 13, 1892, section 3.

**Bonds.**

Required from all persons making disbursements, except officers in the Regular Army.

June 23, 1866, section 3.

March 2, 1867, section 3.

**Chief of Engineers.**

Act providing for filling vacancies in the Office of the Chief of Engineers.

June 10, 1870.

Amended June 30, 1879.

**Civilian Engineers.**

Not exceeding five, may be employed by the Chief of Engineers on surveys and works of improvement of Western and Northwestern rivers, at compensation not to exceed \$3,000 per annum.

March 29, 1867.

Secretary of War shall report at each session of Congress the name and residence of each civilian engineer employed on the work of improving rivers and harbors; also time employed, compensation paid, and peculiar work on which engaged.

August 5, 1886, section 8.

**Commercial Statistics.**

Vessel owners, agents, masters, and others required on application of persons in charge of river and harbor improvements to furnish commercial statistics relating to their vessels.

February 21, 1891.

**Condemnation Proceedings.**

For the acquirement of land, right of way, or material needed to maintain, operate, or prosecute works for the improvement of rivers and harbors, may be instituted by the Secretary of War. Authority given to accept donations of land or material for the maintenance or prosecution of public works.

April 24, 1888.

**Contracts.** (See also PROPOSALS.)

\*No contract shall be made except after public advertisement for proposals and only with the lowest responsible bidder upon sufficient security for performance.

June 23, 1867, section 2.

March 2, 1867, section 2.

March 3, 1875, section 1.

August 14, 1876, section 1.

June 18, 1878, section 1.

March 3, 1881, section 2.

July 5, 1884, section 3.

August 5, 1886, section 5.

August 11, 1888, section 3.

No contracts to be made except under authority of law or an adequate appropriation for its fulfillment.

May 1, 1880.

Separate proposals and contracts must be made for each work. All bids and names of bidders to be submitted to Congress.

June 23, 1866, section 3.

March 2, 1867, section 2.

June 30, 1868, section 2.

(See also following.)

Two or more works of river and harbor improvement may be contained in the same proposal and contract when such works are situated in the same region and are of the same kind or character.

September 19, 1890, section 2.

**Dams.** (See LOCKS AND DAMS.)**Disbursements.**

No disbursing officer in the Army shall receive commissions or compensation for disbursements made.

June 23, 1866, section 3.

March 2, 1867, section 3.

Bonds required from all persons making disbursements, except officers in the Regular Army.

June 23, 1866, section 3.

March 2, 1867, section 3.

**Disbursements—Continued.**

Frequent inquiries to be made by officers of the inspection department of the Army as to the necessity, economy, and propriety of all disbursements by disbursing officers of the Army, and their conformity to the law appropriating the money, and also to the law relating to the manner of keeping accounts and making disbursements.

April 20, 1874.

**Dredging.**

No moneys appropriated for rivers and harbors to be expended for dredging inside of established harbor lines.

July 13, 1892, section 5.

**Engineers.** (See CIVILIAN ENGINEERS.)

**Examinations.** (See SURVEYS AND EXAMINATIONS.)

**Fish Ways.**

To be provided in all locks and dams built by the United States where such constructions operate to obstruct the passage of fish.

August 11, 1888, section 11.

**Government Works.** (See also PUBLIC WORKS.)

Unlawful for any persons to use, build upon, alter, deface, destroy, injure, obstruct, or in any manner impair the usefulness of any sea wall, bulkhead, jetty, dike, levee, wharf, pier, boundary mark, gauges, surveying stations, buoys, or other established marks of the United States.

August 14, 1876.

September 19, 1890, section 9.

**Harbor Lines.**

Secretary of War authorized to establish harbor lines within which deposits or debris of mines or stamp works may be deposited when such can be done without injury to navigation.

August 5, 1886, section 2.

Harbor lines shall be established by the Secretary of War, beyond which no wharves or piers shall be extended, or deposits made, except under such regulations as he may prescribe from time to time.

August 11, 1888, section 12.

Amended September 19, 1890, section 12.

Wharves, piers, dolphins, booms, or other structures of any kind prohibited outside of established harbor lines, or in any navigable waters where no such lines have been established, except by permission of the Secretary of War.

September 19, 1890, section 7.

Amended July 13, 1892, section 3.

No money appropriated for the improvement of rivers and harbors to be expended in dredging inside of harbor lines duly established.

July 13, 1892, section 5.

**Labor.**

Eight hours shall constitute a day's work for all laborers, workmen, and mechanics employed by or on behalf of the United States.

June 25, 1868.

Limited to eight hours in any one calendar day for all laborers or mechanics employed by the Government, or by any contractor upon any public work of the United States.

August 1, 1892.

**Land.** (See CONDEMNATION PROCEEDINGS.)

Acquirement of, for sites of public works.

**Leasing Public Property.**

Authorized by the Secretary of War, under certain conditions.

July 28, 1892.

**Locks and Dams.**

Locks and dams built by the United States, and which operate as obstructions to the passage of fish, shall be provided with suitable fish ways.

August 11, 1888, section 11.

**Materials.** (See CONDEMNATION PROCEEDINGS.)

Acquirement of, for public works.

**Mechanics.** (See LABOR.)

**Mining Deposits.**

May be deposited within lines established by the Secretary of War, where such can be done without injury to navigation.

August 5, 1886, section 2.

**Moneys.** (See PUBLIC MONEYS AND DISBURSEMENTS.)

**Navigable Waters.**

Excavation, filling, or any alteration or modification of the natural capacity of any navigable waters of the United States prohibited, except by the authority of the Secretary of War.

September 18, 1890, sections 7, 9, 10, 11.

Amended July 13, 1892, section 3.

Obstruction of navigable waters by deposits or constructions forbidden, except by authority of the Secretary of War.

September 19, 1890, sections 6, 7, 10, 11.

Custody of navigable waters by officers and agents of the United States.

September 19, 1890, section 11.

All structures declared unlawful which, without permission of the Secretary of War, obstruct or impair navigation, commerce, or anchorage in any navigable waters of the United States outside of established harbor lines, or where no harbor lines are or may be established.

September 19, 1890, section 7.

Amended July 13, 1892, section 3.

**Piers.** (See PUBLIC PROPERTY.)

Use, occupation, or injury of piers or wharves belonging to the United States prohibited.

**Proposals.** (See also CONTRACTS.)

The Secretary of War authorized to prescribe rules and regulations for the preparation and submission of proposals, with condition that the bidder shall enter into contract if bid is accepted within sixty days, and that no bid can be withdrawn during such time.

April 10, 1878.

June 14, 1880, section 1.

March 3, 1881, section 2.

**Public Moneys.** (See also DISBURSEMENTS.)

Shall not be expended on any site or land for public works hereafter, until the validity of the title thereto is established and the consent of the State legislature given to the purchase. Attorney-General to examine titles to all lands or sites purchased by the United States.

September 11, 1841.

**Public Printer.**

Annual reports of the Chief of Engineers and subordinate engineers to be placed in the hands of the Public Printer on or before October 15 of each year, and such reports shall be printed on or before the first Monday of December of each year.

August 11, 1888, section 8.

**Public Property.**

The Secretary of War to report to Congress all cases where piers, breakwaters, or other constructions built by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or individual.

July 5, 1884, section 2.

August 5, 1886, section 4.

The Secretary of War authorized to lease public property under certain conditions.

June 28, 1892.

The embezzlement, stealing, or purloining of any money, goods, chattels, record, voucher, or other valuable property of the United States declared a felony, with provision for the punishment of the same.

March 3, 1875.

**Public Works.**

Labor on, limited to eight hours per day for laborers, mechanics, and workmen.

June 25, 1868.

August 1, 1892.

Protection of breakwaters, piers, and other public property against injury or trespass.

August 14, 1876.

September 19, 1890, section 9.

\* Material required for construction of public works and found on bars and islands, or adjacent to said works, may be taken under certain provisions.

July 5, 1884, section 6.

April 24, 1888.

\* No public work to be deemed as entered upon until appropriations therefor shall have been actually made by Congress.

August 11, 1888, section 14.

September 19, 1890, section 18.

**Public Works**—Continued.

Title to land for public works to be established before any moneys are expended thereon.

September 11, 1841.

**Reports.**

Annual reports to be made for each work, with statement of plan adopted, expenditures made thereunder, amount and dates of all appropriations, estimate for its entire and permanent completion, with amount that can be profitably expended in the next fiscal year; also collection district of each work, nearest port of entry, light-house or port, amount of revenue collected at nearest port of entry for last fiscal year, amount of commerce and navigation to be benefited by each work. These reports shall be continued until the completion of each work.

June 23, 1866, section 2.

March 2, 1867, section 2.

Upon surveys and examinations to state all existing facts tending to show the extent to which the general commerce will be promoted by the works of improvement contemplated.

July 27, 1868.

After the regular or formal report is submitted on any examination or survey, project or work, under way or proposed, no supplemental or additional report or estimate for the same fiscal year shall be made, unless ordered by Congress.

July 13, 1892.

Annual reports of the Chief of Engineers and subordinate engineers to be placed in hands of Public Printer on or before October 15 of each year, and the Public Printer to cause such reports to be printed on or before the first Monday of December of each year.

August 11, 1888, section 8.

**Right of Way.** (See also CONDEMNATION PROCEEDINGS.)

Acquirement of, for public works.

**Surveys.**

\*No survey shall be made of any harbor or river until the Chief of Engineers shall have directed a preliminary examination of the same by the local engineer; and such local engineer shall report whether, in his opinion, such work is worthy of improvement, with all facts and reasons for such opinion; whereupon the Chief of Engineers shall direct the survey to be made, if, in his opinion, the river or harbor be worthy of improvement by the General Government.

August 2, 1882.

July 5, 1884.

August 11, 1888, section 14.

September 19, 1890, section 18.

July 13, 1892, section 7.

Reports on surveys and examinations to state all existing facts tending to show the extent to which the general commerce will be promoted by the works of improvement contemplated.

July 27, 1868.

**United States Officers.**

No disbursing officer in the Army shall receive commissions or compensation for disbursements made.

June 23, 1866, section 3.

March 2, 1867, section 3.

**Vessel Owners.**

Required to furnish commercial statistics on application of persons in charge of river and harbor improvements.

February 21, 1891.

**Wrecks.**

Provision for the removal of wrecks obstructing or endangering navigation, and the sale of parts of cargo or vessel having a salable value.

June 14, 1880, section 4.

Amended so as to provide for sale and disposal of any wreck or property therein before the raising or removal thereof.

August 2, 1882.

All wrecks of vessels and other obstructions to navigation which may have been permitted by the owners thereof, or the parties by whom they were caused, to remain to the injury of commerce or navigation for a period longer than two months shall be subject to be broken up and removed by the Secretary of War, without liability for any damage to the owners of the same.

September 19, 1890, section 8.

**Works.** (See PUBLIC WORKS.)











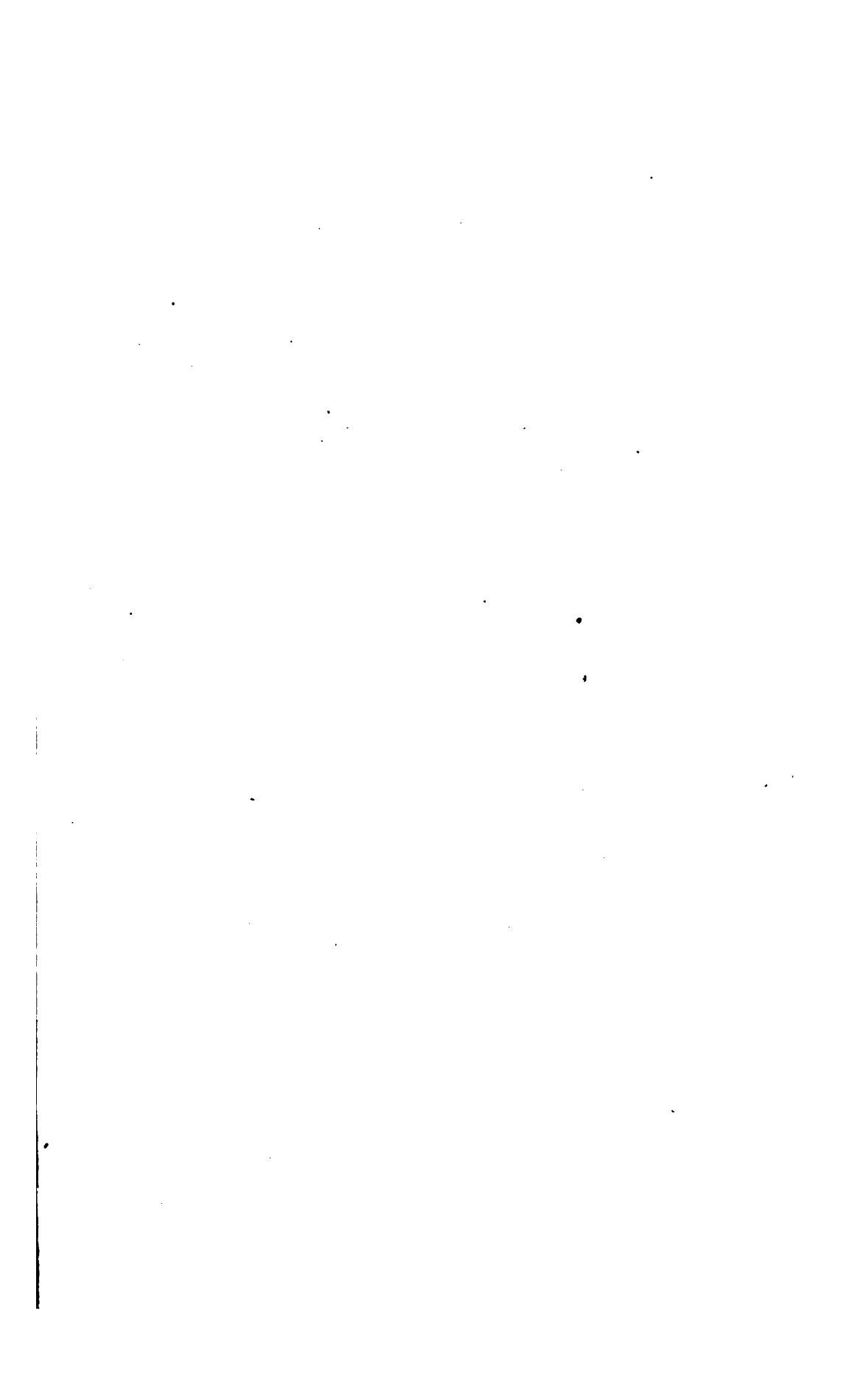
















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